ENGINEERING AND PRODUCTION IN METALWORKING

AUGUST 1960

Machinery

Verson

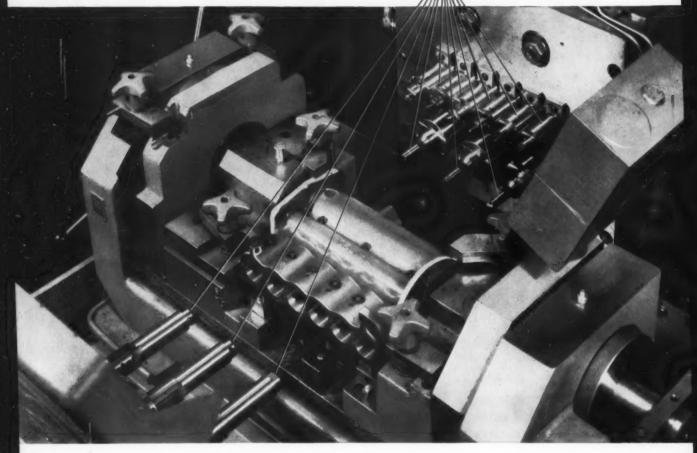
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VERSON ALLSTEEL PRESS COMPANY, Chicago, Dallas



12 HEADS

are better than one



Heald Bore - Matic finishes up to 27 DIFFERENT SURFACES at a single loading

• In the setup shown above, 27 surfaces of 15 bores are done on one machine at a single loading—a Heald Model 222 Bore-Matic with Multi-Spindle heads with a trunnion type fixture. Six deep 3-step bores are done with the three left-hand heads with only one index of the cross slide. After indexing the fixture to hold the work vertical, nine right-angle bores are done at a single pass with the right-hand heads. The same machine also handles four-barrel pump hous-

ings, simply by removing one of the left-hand spindles and three of the right-hand spindles.

On multiple-hole Borizing jobs such as this, interchangeable Multi-Spindle Red-Head boringheads permit many operations to be combined on a single machine, with minimum indexing of the work and positive spacing between bores. Your Heald engineer will be glad to give you complete information.

It PAYS to come to Heald



THE HEALD MACHINE COMPANY

ubsidiary of The Cincinnati Milling Machine Co. Worcester 6, Massachusetts

Chicago . Cleveland . Dayton . Detroit . Indianapolis . Lansing . Milwaukee . New York . Philadelphia . Syracuse



AUGUST 1960 Vol. 66 No. 12

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Machinery

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION
IN THE MANUFACTURE OF METAL PRODUCTS

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THIS THREAD ROLLING OPERATION

will come to life at MMT-pE



booth 432

The Thread Rolling operation illustrated here, and a series of other threading operations, will be demonstrated by the Landis Machine Company in Booth 432 at the Machine Tool Exposition. At the booth you will get a close first-hand look at how Thread Rolling has proved to be beneficial in many ways to a growing number of users.

You will see demonstrated on the LANHYROL and LAN-NU-ROL Thread Rolling Machines: 1 Infeed Rolling that reduced overall cost by 80%; 2 Continuous Knurling and Rolling in one spindle revolution; 2 Reciprocal Rolling of large diameters; 4 Automatic Infeed Rolling of involute splines; 5 Roll-straightening of double-end studs; 6 Continuous Rolling of extra long threads; 7 Automatic Thrufeed Rolling; 8 High Production Infeed Rolling; 9 Infeed Rolling of large diameter double-end studs; 10 Automated Infeed Rolling.

TAPPING and CUTTING operations will also be demonstrated on the Coupling Tapping Machine, the 4-Spindle Semi-Automatic, and various models of the LANDMACO Threading Machine. These include: (1) Automatically tapping threads in external upset tubing couplings; (2) Cutting threads on insulator pins at a high production rate; (3) Cutting large diameter threads; (4) Cutting threads on close nipples automatically; (5) Cutting threads with an automated LANDMACO Threading Machine.

In addition, the complete line of Die Heads, Taps, Thread Rolling Attachments and Thread Rolling Heads will be displayed. Experienced LANDIS engineers will be available to discuss any problem dealing with method, equipment, or thread design.



WAYNESBORO, PENNSYLVANIA
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

gear headquarters at the



BOOTH 929

SHAPE No. 4GS Fellows Gear Shaper



HOB P.400 Fellows — Pfauter Hobber



FINISH No. 4BGS Fellows Gear Finisher



NMTBA EXPOSITION

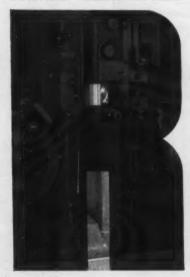
If you use gears (and who doesn't?) you'll want to look in at the Fellows booth to see the latest in gear production equipment.

If you produce your own gears, you'll want to make booth 929 your first stop.

Here you'll see an array of manual and automated machines designed to handle almost any spur or helical job, right from the blank to the finished gear. You'll see the famous Fellows Gear Shaper, as well as other Fellows machines for hobbing, finishing, grinding and inspecting, and a machine for sharpening helical gear shaper cutters.

Remember the booth number: 929. Trained Fellows specialists will be on hand to explain the machines and to answer any questions you may have.

GRIND No. 12 Fellows - Reishauer Gear Grinder



INSPECT No. 4 Fine-Pitch Red Liner



SHARPEN No. 6SA Helical Cutter Sharpener



THE FELLOWS GEAR SHAPER COMPANY 78 River Street, Springfield, Vermont, U.S.A.

Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
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Gear Production Equipment

THE PRECISION

NEW VERCI POWER



LOW-SLUNG AND POWERFUL, the new VerciPower offers unusual flexibility for toolroom and production milling. Dual operating controls at front and left rear provide utmost operator convenience.

BUILDERS OF FINE MACHINE TOOLS: KNEE TYPE AND BED TYPE MILLING MACHINES . DIE SINKING MACHINES

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

ALL-PURPOSE MILLING MACHINE VERSATILE...POWERFUL...FAST

VerciPower gives you an opportunity to take a big bite out of machining costs. Verci-Power . . . the unique new all-purpose milling machine that combines toolroom flexibility of knee-types with the rigidity and cutting capacity of manufacturing and bed type machines.

Low-slung powerful construction is the key to VerciPower's inherent ruggedness and speed. The saddle and table move directly on the machine bed of convenient fixed height—there is no movable knee. Vertical movement is provided by the spindle carrier. Hardened ways, narrow guides and square gibbing on both bed and head-stock maintain the original built-in accuracy for years.

VerciPower incorporates many outstanding feature-advantages:

Two complete and independent sets of controls, one at front and one at rear for maximum operating convenience

- Arbor-Loc spindle nose, to simplify and speed the changing of cutters
- Fixed table height of 39"—easier to load and unload work
- ▶ Table traverse handwheel at the front; a desirable setup convenience
- ▶ 24 spindle speeds and 32 feed rates (in geometric progression), selected by power from front or rear
- Automatic Backlash Eliminator, for climb or conventional milling
- Dynapoise overarm; an exclusive Cincinnati feature that damps self-excited chatter, smoothes the cutting action
- Automatic table cycles—standard equipment on all sizes

VerciPower is a new mighty work horse, expertly designed and equipped to handle a great variety of your milling operations. May we give you more information? Write for new catalog M-2130, or a visit by one of our field men.







Booth No. 1034

CINCINNATI VERCIPOWER MILLING MACHINES for all-purpose milling are available in four sizes: 20 or 30 hp, 34" or 42" table travel, each with 22" vertical travel of spindle carrier. New catalog No. M-2130 contains complete specifications.

CUTTER AND TOOL GRINDERS . ELECTRICAL DISCHARGE MACHINES

CINCINNATI

only the

allNEW

LANDIS

centerless grinder

has all

these features...

be sure to see LANDIS at the MTE

.. the line of precision grinders

Landis No. 12R centerless grinder for automatic grinding of automotive valves.

allNEW

dinew bed—no hydraulic oil or open drains in bed...maintains better machine alignment

CONTROL OF STREET WHEN THE STREET WHEN THE STREET WHEN THE STREET STREE

all NEW truform dresser—with both slides on preloaded balls for exact dressing and profiling of grinding and regulating wheels

all NEW rotary diamond tool and crush dressing

—available for profiling grinding wheels with Truform dresser

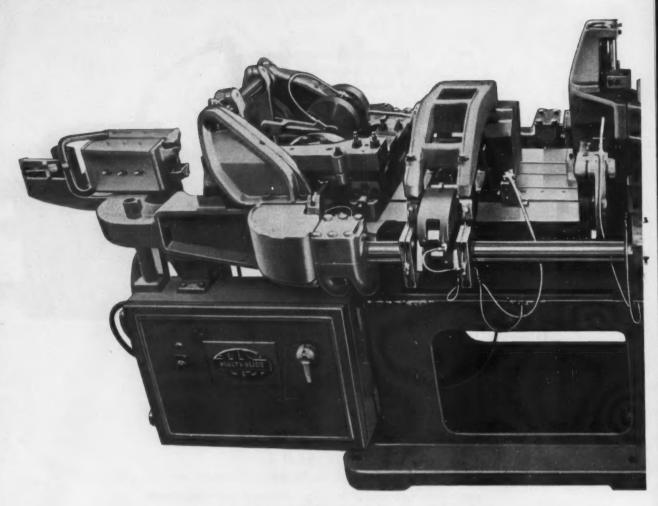
all NEW Landis lockspeed regulating wheel drive

—for rounder workpieces and faster grinding cycles

LANDIS

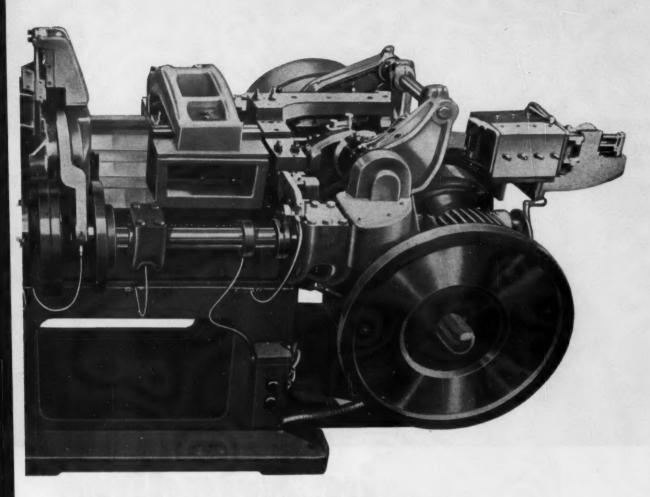
world leader in precision grinders

Landis Tool Company, Waynesboro, Pennsylvania



U.S. DUPLEX MULTI-SLIDE SIMULTANEOUSLY FEEDS AT BOTH ENDS PRODUCES TWO OR MORE STAMPINGS FORMS ASSEMBLES

The new U.S. Duplex Multi-Slide is a double ended machine which more than doubles previous production potentials.



With the U. S. Duplex you can Produce and assemble 2 different stampings from the same or dissimilar materials.
Produce and assemble 2 complementary stampings. Produce stampings from one end, wire form from the other end and assemble. Produce 2 stampings and assemble with hopper-fed, prefabricated parts. ■ Make 3 piece assemblies, feeding material from both ends - and from the top.

Make 2 or more identical or different stampings not requiring assembly - and of the same or different material. And, can be operated as a conventional Multi-Slide by feeding material into one end only. Standard U.S. Duplex Multi-Slide equipment includes a feed, stock straightener, check and ram action at each end and a common 4-slide forming position with double, vertical strippers at the center. Material up to 3" wide can be fed into both ends of machine simultaneously. Feed length is adjustable up to a maximum of 6" and can differ from each end of the machine. Investigate the economies a U.S. Duplex Multi-Slide can give you. A few of these are: elimination of secondary operations; savings in floor space; ease of inspection of finished assemblies; and fewer rejects . . . all through the versatility of the "Duplex".

Write today for full information and specifications. Send us your samples or drawings today and let us show you.



See the U. S. Duplex Multi-Slide in Booth No. 842 at the 1960 Machine Tool Exposition.



U.S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY
U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Raom Equipment • U. S. Die Sets and Accessories

THE BIGGEST in grinding

outstanding all NEW features





AUTOMATIC ROTARY DIAMOND WHEEL DRESSING

AUTOMATIC MICROFEED



NOW... A COMPLETELY AUTOMATIC INDEXING CRANK GRINDER

at the MTE

Landis Rooth 823

NEWS

automation



LANDIS

world leader in precision grinders

Landis Tool Company, Waynesboro, Pennsylvania

The wheel head TILTS 30°!...

The NEW NORTON No. 200 Cutter and Tool Grinder makes setups simpler . . . easier . . . quicker!

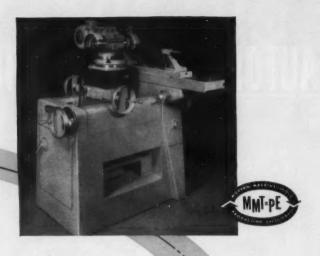


Tool room men can tell you that grinding a taper reamer is one of their toughest jobs. But now they're discovering that it and other tough tool grinding jobs are a "snap" with the new Norton No. 200. Because:

You can tilt the wheel head up to 15° above or below horizontal — and swivel it through a full orbit of 360°.

And the table has a very rugged, extremely accurate guide bar, which assures precision in tracking, during the most difficult grinding jobs.

All this means no more time-wasting "cut and try" tactics... no more wrestling with tricky setups... a wheel head scale provides quick direct readings of clearance angles... for practically all grinding on centers, the



ORBITS 360°

VISIT BOOTH #651
Machine Tool Exposition • 1960
INTERNATIONAL AMPITHEATRE
Chicago — September 6-16

tooth rest can be kept on the center-line of the cutter, eliminating time losses from additional settings . . . the table design enables use of gage blocks for quick taper grinding setups and fast return of table to straight setting . . . greater wheel head capacity through eccentric mounting simplifies approach to many special jobs.

In addition:

The No. 200's extremely solid grinding action brings you excellent finish on tool cutting edges, with resulting benefits in tool life and performance. That's because the No. 200 is a wheel slide type machine, where grinding is always within the area of the rigid base, with no instability due to work overhang. Other advanced features include: quick-change two-speed wheel drive; centrally located column controls, wheel slide dials readable from any position.

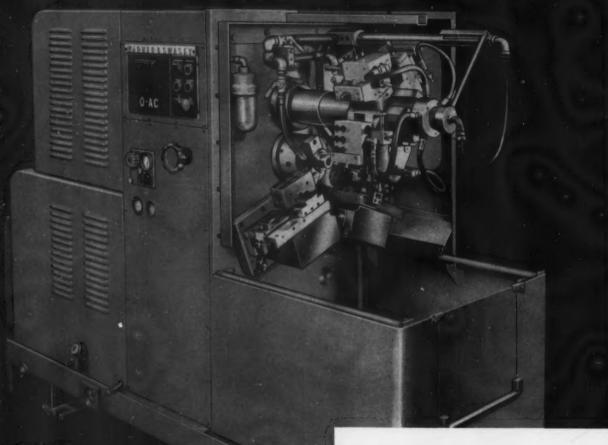
Your Norton Man, a trained grinding engineer, will be glad to show you how the new Norton No. 200 cutter and tool grinder can help you modernize and economize in your plant. For catalog #1371, write to NORTON COMPANY, Machine Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5.



75 years of ... Making better products ... to make your products better

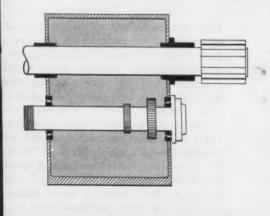
MACHINE TOOL DIVISION: Grinding and Lapping Machines - & & E DIVISION: Shapers . Sear Cutting Machines . Sear Induction Mardeners

NOW YOU CAN <u>AUTOMATE</u> PRODUCTION



6" DIA, CHUCK 6" SWING 3" TURRET STROKE SPEEDS 87 to 2507 RPM

Spindle rise has been practically eliminated in the O-AC by placing the spindle and turret bearings in the same housing where they are subjected to exactly the same temperature, and continually lubricated with clean, filtered oil.



OF SMALL PRECISION PARTS with the New Warner & Swasey O-AC Single Spindle Chucking Automatic

Warner & Swasey's newest addition to its proven line of Single Spindle Chucking Automatics — the O-AC — is specifically designed to automate the production of small precision parts in all lot sizes — even as few as 30 or 40 pieces.

SMALL LOTS are profitable on the O-AC because it sets up fast and can be changed from job to job quickly and easily. There are no cams to design, change or store. The tooling area is uncluttered, easy to get to for faster cutter setting and adjustments.

PRECISION work piece tolerances and fine finishes on a repetitive piece-after-piece automatic basis are routine for this new single spindle chucker. Because of its unique overhead turret construction, only the O-AC can assure this high degree of production accuracy.

VERSATILE PERFORMANCE results from the O-AC's unique tool slide actions. A wide range of work — from ordinary small castings to complicated missile components — is efficiently handled, usually with low-cost standard tooling.

Your Warner & Swasey Field Engineer has the complete facts on the new O-AC ready for you. Or write us direct, Warner & Swasey Co., Cleveland 3, Ohio.

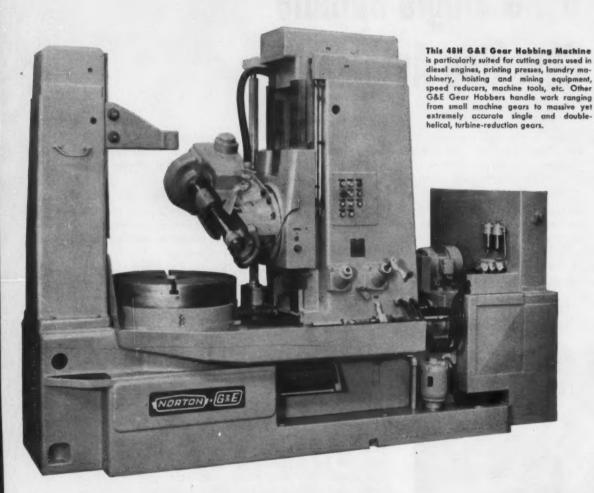


All automatic functions are rapidly set up by the simple placement of trip blocks and switch operating screws. All automatic functions can be individually hand controlled during setup and switched to "automatic" or back to "hand" at any time with a single control switch.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY



How G&E gear hobbers combine
high precision with high production...



for your high profits

Gould & Eberhardt Universal Gear Hobbing Machines meet practically every industrial gear cutting requirement. Built for fast, dependable performance, they're established cost-cutters for rapid production of spur gears, single and doublehelical gears, sprockets, splines, worm gears, worms, ratchets and special forms — in a wide range of pitches and diameters.

Highest production at lowest hob cost is assured by the highly developed vertical cutting principle, substantial hob support, gear trains and adjustment features.

And here's a fact it will pay you to remember:

The original productivity and accuracy built into hobbers by G&E is maintained at highest levels—and with every possible advancement—by the assimilation of G&E experience and personnel into the progressive and modern machine tool building operations of Norton Company.

For careful help in selecting Gear Hobbers or other G & E equipment that will benefit your production see your G & E dealer or write to Norton Company, Gould & Eberhardt Division, Worcester 6, Massachusetts.



75 years of ... Making better products ... to make your products better

HIGH PRECISION HIGHLIGHTS

Vertical Feed. Optimum accuracy is secured by a large diameter feed screw, precision-cut in a temperature-controlled laboratory and rigidly anchored in tapered, preloaded precision roller bearings. Backlash control is maintained by an easily adjusted two-piece bronze feed screw nut.



Indexing. DUALEAD® worm-gearing assures accurate indexing under heaviest production. The worm thread, with progressive variation throughout its length, simplifies adjustment by providing backlash control without change of center distance and insures uniform transmission of motion in both directions of rotations through proper conjugate tooth action, thus maintaining accuracy of index under high operating speeds and over an extended period.

The maximum wear-resistance quality of the mating chill-cast nicket bronze DUALEAD index worm gear results in minimum wear to maintain extreme accuracy longer.



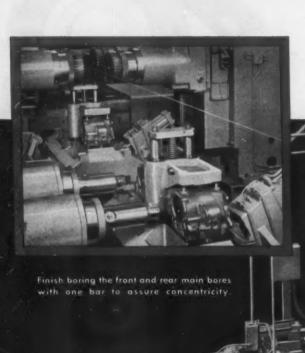
HIGH PRODUCTION HIGHLIGHTS

Rapid, Precise Hobbing. Speed and accuracy for sustained high production rates — as well as extra-long service life of hobs and machines — are assured in G & E Hobbers because:

- ... The heavily proportioned, easily adjusted hob slide travels on double rectangular guides for sustained accuracy in basic motion.
- ...The single-helical final-drive gear to the hob is independently mounted on large antifriction bearings to prevent compounding stresses on the hob spindle.
- ... The fixed-position work table is located in a large tapered bearing and supported by a flat annular bearing to absorb cutting stresses.
- ... The hob arbors are heat treated and chrome plated to reduce wear and eliminate the tendency to raise burrs which cause eccentricity and hob wobble.

Cross Introduces Automation for High Precision Boring and Facing

Many Unusual Features in New Transfer-matic for Machining Transmission Cases





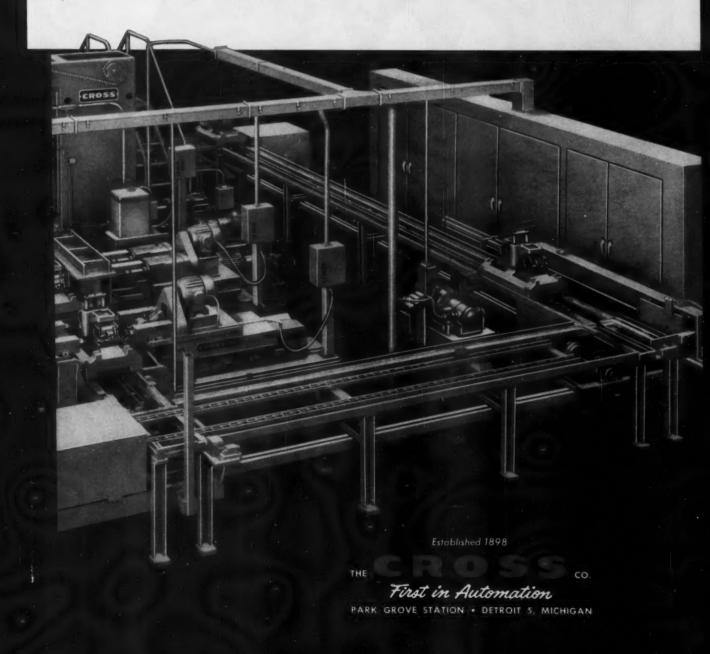
Operations include boring the main shaft, counter shaft, reverse idler, and two shifter rod bores and precision facing both ends.

An unusual new Transfer-matic which applies the production economies of automation to high precision finishing has been designed by Cross. It bores and faces transmission cases at a rated capacity of 140 parts per hour despite the rigid accuracy.

Some bore sizes are held to tolerances of plus or minus 0.00035 inch and chordal dimensions between three holes are held within plus or minus 0.001 inch. Squareness between the ends and bores is maintained to 0.0005 inch. Surface finish specifications are 56-110 micro-inches, rms.

A number of special features have been developed to assure this high precision. Center bases and wings are integral to obtain the rigidity necessary for maintaining precision alignment. Pallet locating is designed to assure extreme accuracy from station to station. Strategically placed air jets check the position of the pallets in each station.

A Cross sales engineer will be glad to explain details of this unusual Transfer-matic and other Cross innovations.



FROM CREATIVE CRUCIBLE: HIGH SPEED STEELS THAT MAKE BETTER TOOLS POSSIBLE

UNGROUND CLASS "C" HOBS, made from Crucible's M2S, consistently meet runout tolerances as required.

ACCURATE HOBS-

WITHOUT GRINDING! Toolmakers hold hob tolerances to less than 0.001" without finish grinding—because of improved manufacturing skills and continually improved Rex® High Speed Steels.

Today's toolmakers are not only producing accurate unground hobs to closer tolerances — they're also making them stronger, longer-lasting and with fewer grinding stresses.

What is behind this development? It's the skill of the toolmakers — combined with continuing Crucible developments that improve the quality of Rex High Speed Steels. Crucible tool steel metallurgists, working closely with producers of fine precision tools, are able to devise mill manufacturing practices to provide steels ideally suited to specific applications.

At Crucible, Rex High Speed Steels have always been produced under the close personal supervision of the most experienced men in the industry. Today, these men utilize the most advanced electronic instrumentation to assure the production of highest quality steels. For example, they use precision instruments to control the temperature of the molten metal, in the melting furnace, so each heat is produced under identical conditions. New techniques permit greatly improved deoxidation of the liquid steel. New ingot mold designs provide freedom from segregation when the steel solidifies. And all Rex High Speed Steel billets are inspected ultrasonically before they are rolled or forged.

As a result, Rex High Speed Steels continue to make the best hobs because they offer:

more uniform distribution of carbides throughout the section. This ensures minimum size change, greater predictability in heat treatment, greater hardenability and more uniform hardness in the heat-treated tool:

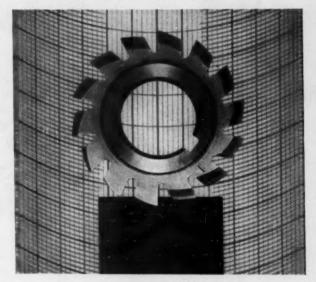
more uniform distribution of sulfides in the free-machining grades.
And this provides improved machinability and superior surface finish.

Single-Thread Gear-Hob Tolerances (in Ten Thousandths of an Inch)

DIAMETRAL PITCH											
	1 Thru 1,999	2 Thru 2.999	3 Thru 3,990	4 Thru 4.999	5 Thru 5,990	6 Thru 0.393	9 Thru 12.999	13 Thru 19,996	20 Thru 29.999	30 Thru 50.999	51 and Finar
RUNOST											
Outside Dia, C	50	45	- 40	25	20	17	17	12	12	- 10	

Table: Metal Cutting Tool Handbook

FINAL PROOF OF A HOB'S ACCURACY. This lead variation chart, produced by a special electronic recorder, provides a check of every tooth in the hob. Checks are made "against perfection"—so, any deviation shows up on the chart. Photomicrograph shows tooth area's structure and the uniform distribution of carbides in Crucible Rex M2S. (Photo: 100X dia.)





BETTER TOOLS, THROUGH BETTER STEELS. The constant improvement of Rex High Speed Steels ensures the increasingly greater performance of fine twist drills, taps, broaches and cutters—as well as hobs.





CRUCIBLE

STEEL COMPANY OF AMERICA

Branch Offices and Warehouses: Atlanta · Baltimore · Boston · Buffalo · Caldwell, N. J. Chariette · Chicago · Cincinnati · Cleveland · Columbus · Dallas · Dayton · Denver · Detroit · Erie, Pa. · Grand Rapids · Houston indianapolis · Los Angeles · Miami · Milwaukee · Minneapolis · New Haven · New York · Phitadelphia · Pittsburgh · Portland, Ore. Providence · Rockford · Salt Lake City · San Francisco · Seattle · Springfield, Mass. · St. Louis · E. Syracuse · Tampa · Toledo · Tulsa

You can bore holes round within 20 millionths and bore them FASTER at lower cost with the NEW



Here are some of its advantages:

Two Heads Are Better Than One. Two Horizontal Boring Heads moving from both directions simultaneously over a stationary work table increase your production. Two heads working are more profitable than one.

Pope Precision Boring Heads are motor driven and all of their rotating parts are dynamically balanced. Lubrication - Pope System. These precision boring heads run cool, a necessary feature for precision boring.

Standard center height -5½" (variable)

Hydraulic Drives operate the spindle head slides, and the work table cross slide if desired, assuring smooth rapid traverse, precision fine feed control.

Uniformly Low Operating Temperature for the entire machine - added assurance of continuous production of accurate parts.

New Pope Electric Programmer is a unified, separate console containing all the electric controls for fast operation; duplicate set-ups can be made quickly.



These and other exclusive features put this Precision Double End Boring Machine way out front for production, precision and profit. Ask for Bulletin No. S-21.



ENGINEERS, DESIGNS AND BUILDS ECISION ANTI-FRICTION BEARING SPINDLES FOR EVERY PURPOSE

CORPORATION . 261 RIVER STREET . HAVERHILL, MASS.

No. 131

Grinds to today's

PRECISION TOLERANCES

with Gardner double spindle grinders





steel guide tab stock removal: .005"—.007" flatness: .0005" parallelism: .0005"



steel friction gear stock removal: .009° flatness: .001° parallelism: .001°



steel lover margin control stock removal: .008"—.010" max. flatness: .0003" parallelism: .0003"



steel magnet yoke stock removal: .008" flatness: .001" parallelism: .001" uniformity: ±.0009"

brass bracket stock removal: .010" flatness: .002" in 1 inch parallelism: .001" uniformity: ±.001"



Gardner 2H30 precision double spindle grinder one of many Gardner machines capable of producing precision parts at high, cost-saving output . . . Send prints of your parts for a Gardner proposal.



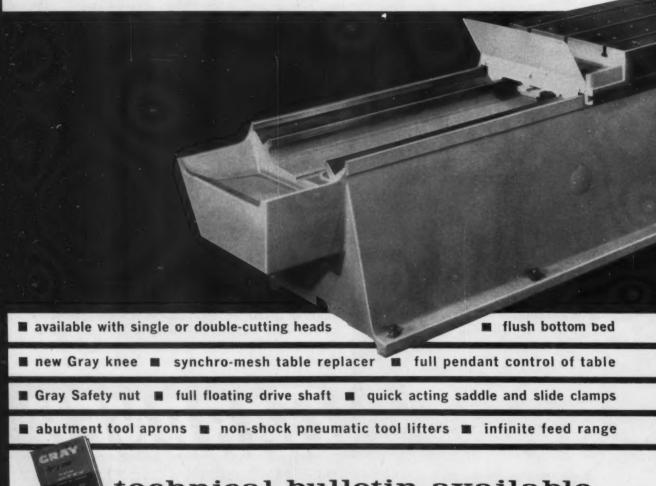
precision disc grinders

imagine

buying a GRAY planer for only

\$30,660

above basic price includes 30" x 6' planer, one rail head, electric drive and controls



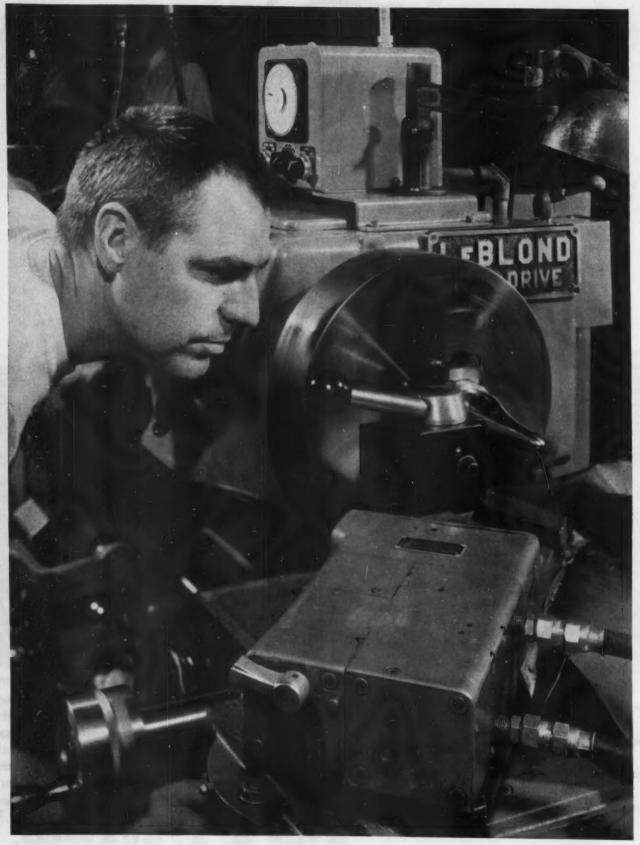
technical bulletin available



the - - - - VA V BOW-36W-42W flying scot

- square locked throughout knee and rail counterbalance pyramid side walls on bed
 - vee ways gray non-metallic ways—optional maximum capacity—table width
 - 'reservoil' lubrication high table speeds duplex tables optional new column
 - helicone transmission space saver drive table safety stop forced lubrication

horizontal milling and boring machines planers planer type milling machines



28

FINISH:

Reason enough to buy LeBlond

The glass industry is beginning to turn to mold plungers hard-surfaced with Colmonoy 6 to withstand the corrosion of molten glass. At 57-59 Rockwell C hardness, you don't machine such plungers on ordinary lathes—if you can machine them at all.

Yet Overmyer Mould Company of Winchester, Ind., turns Colmonoy coated plungers in 3 passes to a 10 micro-inch finish. That's more than fine enough to use as-machined.

Overmyer does it with 15" LeBlond Dual-Drive Lathes equipped with LeBlond tracers and constant surface speed control. From 1000 rpm at start of cut to 125 rpm at finish the Dual-Drives supply smooth, vibrationless power.

Rock-steadiness for turning rock-hard materials . . . Rigidity without excess weight or size . . . These are strong reasons to buy a lathe. They are reason enough to buy LeBlond.



THE R. K. LeBLOND MACHINE TOOL CO.
World's Largest Builder of a Complete Line of Lathes
CINCINNATI 8, OHIO

MACHINERY, August, 1960



Report to the SMTS* Committee

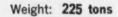




SEE SMTS ECONOMATICS . BOOTH 1440 MACHINE TOOL EXPOSITION

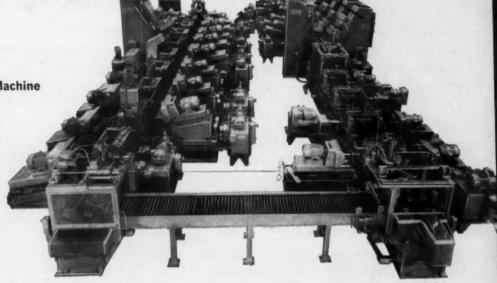
BUHR'S BABY

arrives on time ...



Length: 220 feet

Genus: Transfer Machine



What's all the excitement about? Buhr's Baby, the first major machine built to the Special Machine Tool Standards, has been delivered to its proud owner—a major American automobile manufacturer. And it's some baby!

A lift-and-carry, part-through transfer, with fifty-eight stations, the machine is designed to perform 323 precision operations in automatic sequence on cylinder heads for a 1961 model automotive engine. Operations, in addition to

rough and finish machining, include probing, sealer application, assembling, pressure testing, rejecting and injecting . . . you name it. It's fast, too. The work cycle is only 30.0 seconds. Capacity at 100% efficiency is 120 pieces per hour. It's some baby, alright! Because it was built to the new Standards, it's the most flexible and readily convertible multiple operation machine tool ever built. It's the first in a broad new line of SMTS Babies that Buhr is now building.



BUHR MACHINE TOOL COMPANY

ANN ARBOR, MICHIGAN



Details of Verson Press Shown on this Month's Cover . . .

Press Forming of Heavy Gauge Truck Brake Mounting Plate

Forming of heavy gauge truck brake mounting plates at The American Stamping Company in Cleveland has been reduced to a simple draw and restrike operation by a 1500 ton Verson Press.

Sometimes called a "backing plate," the piece part is fabricated from a blank \(^1/4''\) thick by 19\(^1/8''\) in diameter. Although the draw operation requires considerably less than the capacity of the press, the nature of the restrike operation requires full press capacity to obtain the necessary profile accuracy.

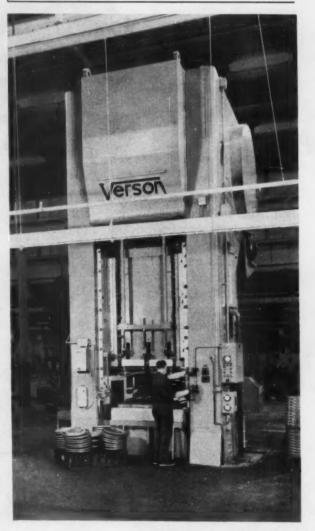
Of particular interest is American Stamping's use of Verson's mechanical tonnage indicator as a die setting tool. As a result, dies can be set entirely by direct readings on the tonnage indicator without the time consuming custom of trial and error or concern for the die setter's judgment. The tonnage indicator will also warn of overloads as well. This is particularly helpful in view of American Stamping's use of this press on a wide variety of other applications.

Another Verson Press of 500 ton capacity is also used to form in similar manner the backing plate for one of the new compact cars. The material in this case is .109" thick and 11¾" in diameter. Aside from piece part configuration, forming procedure is the same as for the truck backing plate.

For more detailed information on these or other presses or press applications, write Verson Allsteel Press Company, 1355 East 93rd Street, Chicago 19, Illinois.

Press Specifications

Capacity: 1500 tons
Area of Bolster: 54" x 60"
Strokes per Minute: 10
All lubrication of the press is automatic. Bed is equipped with Verson pneumatic die cushion.



241-BW

Less than 10 hours maintenance on 6 Wichita equipped presses in last 2 years INCREASES DIE LIFE 50%

Less than 10 hours of maintenance time has been required on six Wichita Low Inertia Air-Tube Clutches installed on Bliss presses at Pratt & Whitney Aircraft's Southington, Connecticut branch plant over two years ago. During this same period a P&WA study indicates that die life has been increased about 50% over previously used mechanical clutches.

The use of Wichita Air-Tube Clutches and Brakes has made similar savings possible for many types of presses and other metalworking machines as well as clutching and braking applications in many other industrial applications from workboats to papermills. Write for details on possible savings for your individual power applications today.

Call your nearest Wichita Engineer

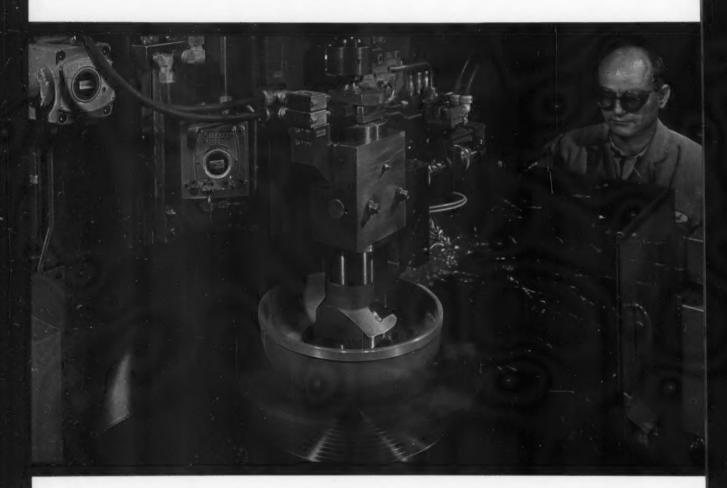
Clutch & Control Engineering Co., Livonia, Mich. Fremont & Lewis, Inc., Cincinnati, Ohio W. G. Kerr Company, Pittsburgh, Pa. Smith-Keser & Co., Avon, Conn., Philadelphia 44, Pa., and New York, N. Y. Frank W. Yarline Co., Chicago, Illinois Larry W. McDowell, Long Beach, California

Andrew T. Lobel, Denver, Colorado Robert R. King Co., Cleveland, Ohio Norman Williams, Houston, Texas Allied Transmission Equipment Co., Kansas City B, Missouri Donald E. Harman, Dallas, Texas C. Arthur Weaver, Richmond, Virginia



Malcolm S. Cone, Memphis, Tennessee Dominion Power Press Equipment, Ltd., Burlington, Ontario, Canada R. E. Kunz, Seattle 4, Wash. Norman Rupp Co., Portland 4, Ore. Bates Sales Co., St. Louis 1, Mo.

introducing a dramatic new concept in metal chip removal **MOTCH and MERRYWEATHER**



CUTTING POWER ON COMMAND! Each Vertical Turner is engineered to your specifications from production-built low-cost components. Initial machine costs are slashed! Costs of parts made with this tool are cut in half and more!

Never has there been a machine tool which has met with such immediate enthusiasm by production men. It provides utility and productivity in a versatile package to fit your specific turning, facing, tracing, and boring needs!

Check these sensational cost-cutting advantages and features and phone our distributor today for an appointment to see and learn more about this revolutionary new machine tool. We'll be happy to show you how to replace obsolete metal-cutting machines - profitably!

Time comparison on machining motor end bells at Electra Motors, Anaheim, California.

OLD WAY

Part A-8274 (Frame 284 and 286)

Operation #1 — chuck on motor bosses in

4-jaw chuck: Rough turn 13" Dia. O.D. Rough bore to 3.936 Dia.

Fin. bore to 7.040 Dia. - Time: 3.7 min.

Fin. bore to 7.090 bis.

Operation #2 — Reset tools:

Fin. turn 13" Dia. O.D. — Time: 1.7 min.

Fin. bore 3.9369 Dia. — Time: 6.2 min.

Total Time: 11.6 min.

A Motch-Merryweather Model I-V Vertical Turner does all of these operations at one chucking and in one continuous cycle in 46 seconds

Vertical Turner

MOTCH MERRYWEATHER

RIGID CAST COLUMN HOLDS TOOL POSITION ACCURATELY

ALL HYDRAULICS EXTERNALLY MOUNTED

TOOL SLIDES MOUNTED ON HARDENED AND GROUND WAYS

TOOL POSITIONS
EASILY CHANGED

TREMENDOUS TURNING POWER AT THE SPINDLE SPINDLE RUN-OUT HELD TO .0002"

HAND-HIGH CONTROLS

PUSH-BUTTON CHUCKING

CHIPS STAY CLEAR FOR EASY REMOVAL

SIMPLE, AUTOMATIC, SEQUENTIAL PROGRAMING

BASES OF HEAVY INTERNALLY-RIBBED CAST IRON OCCUPY 50% LESS FLOOR AREA

ALL COMPONENTS CAN BE ASSEMBLED AS DESIRED OR CHANGED AT WILL

MODEL I-V

MOTCH AND ==== MERRYWEATHER

1250 East 222nd Street CLEVELAND 17, OHIO

BIRDSBORO Presses ...

designed to meet changing method, material, market and cost problems

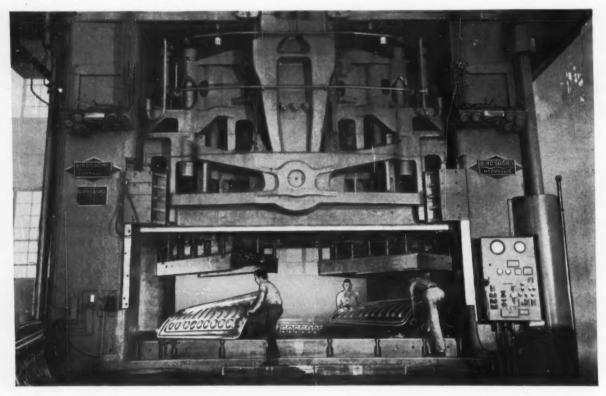
• Birdsboro is gearing its press designs in the same way you are gearing your entire business . . . for both present and the future.

Changes in markets, methods, materials and costs are pushing the "future" closer and closer to today. To help you meet these problems, Birdsboro presses are versatile and rugged enough to fit into your



production future as well as the present.

Advanced design, triggered by imagineering, provides you with longer usable life in each press. Ask your Birdsboro representative about specific examples. Sales Department: Reading, Pa., Engineering Department and Plant: Birdsboro, Pa., District Office: Pittsburgh, Pa.



HP41-59

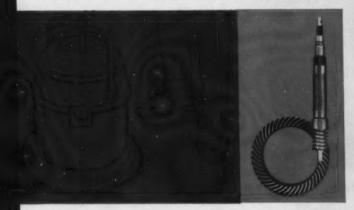


BIRDSBORO

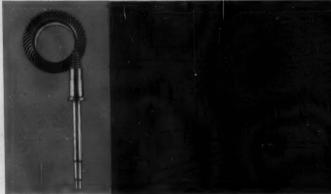
STEEL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • STEEL CASTINGS • Weldments "CAST-WELD" Design • ROLLS: Steel, Alloy Iron, Alloy Steel.



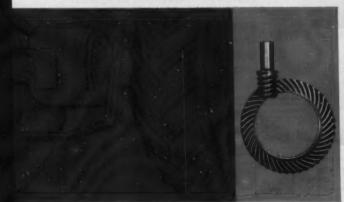
WHICH OF THESE HIGH-RATIO HYPOIDS IS "JUST RIGHT" FOR YOUR PRODUCT?



For hand tools. Where space is a problem—as in portable tools like this one—the high offset lets you design a more compact unit. Choose just the offset to solve your design problem with a more flexible, more compact unit than the corresponding worm and wheel.



... or machine tools. This high-offset pair lets you combine high reduction with strength, compactness and other advantages you might find profitable in designing machine tools. High-ratio hypoids can be produced on Gleason equipment for ratios of 1:10, 1:40 or even higher.



Big and strong. Where you need strength—as in farm machinery—high-offset hypoid pinions (with teeth which tend to "wrap around") are larger and stronger than corresponding bevel pinions. An extended shank on cylindrical pinions makes very rigid straddle mountings practical.



... or small and smooth. For smooth operation—as in office equipment that must run quietly—high-offset pairs provide smooth, quiet tooth action. Because teeth "wrap around" the pinion, you get continuous action—even with just one or two teeth! Grinders are available for applications requiring precision finish.

High-offset or high-ratio hypoids can be cut, tested, and quenched on the same Gleason equipment that is used on more familiar spiral bevel and hypoid gears. You can get more information about Gleason high-ratio hypoid gears by writing for free literature. Submit your prints for recommendations.

GLEASON WORKS

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

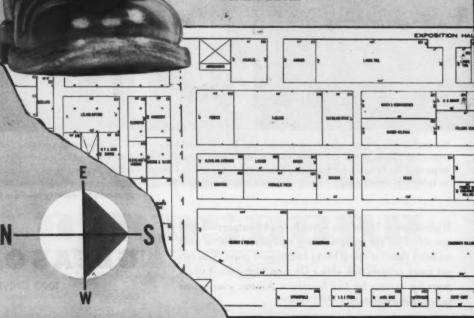


Don't take metal sawing for granted! There is more opportunity to save money in cutting off operations today than ever before. To see why, make 1340, the MARYEL space location in the Machine Tool Exposition a sure stop when you're in the Amphitheater.

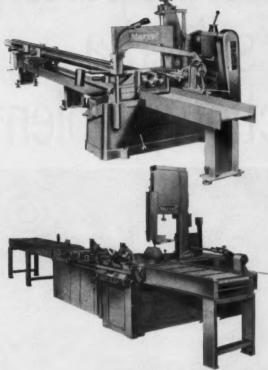
Tons of steel will be cut-up by 14 MARVEL Hack Saw and Band Saw Machines in the largest sawing demonstration ever made — anywhere or at anytime. Among other things, you will see the most important development in metal sawing — the MARVEL "Sure-Line" Automatic Accuracy Control.

Finally, if you have a specific sawing problem, we can prove to your satisfaction, that MARVEL Saws are designed and built to outperform any other saw on the basis of speed, accuracy, and cost per cut.

Come in and see!



your feet south to space



1340

to see the LARGEST, MOST
COMPLETE SAWING DEMONSTRATION
in the Amphitheater

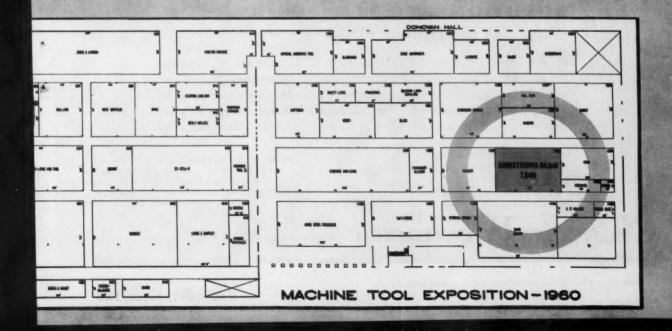
Be sure to see the MARVEL "Sure-Line" (patented) AUTOMATIC ACCURACY CONTROL



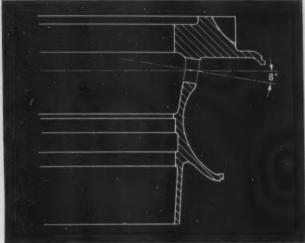
ARMSTRONG-BLUM MANUFACTURING COMPANY

5700 WEST BLOOMINGDALE AVENUE

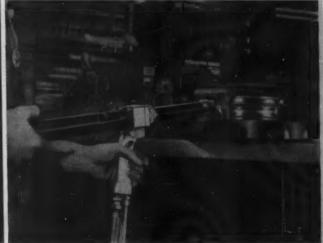
CHICAGO 39, ILLINOIS



How one aircraft parts subcontractor solved a tough production problem



Sectional drawing showing the inclination of hole at 8° to center line. Center lines of holes are required to be true within .010".



Close-up of Broach Gun, jig and fixture, showing ease of operation.

PROBLEM: MAKE 90 HOLES .281" SQUARE IN

13" DIAMETER STAINLESS STEEL RING TO ± .005" TOLERANCE

AND AN INEXPENSIVE FIXTURE

B. H. Aircraft Co., Inc., of Farmingdale, N. Y., is making a missile engine thrust chamber component for a major engine manufacturer. The problem of producing such close tolerance square holes could have been a major stumbling block. However, by using a CP Portable Broach Gun and a simple jig and fixture, these components are being produced in quantity with *never a reject!*



Right: Broaching operation at B. H. Aircraft Co., Inc., showing simple jig and fixture. The portability of the CP Broach Gun and its self-contained Power Cell makes this an easy one-man operation.

8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS . ELECTRIC TOOLS . AIR COMPRESSORS . DIESEL ENGINES . HYDRAULIC TOOLS . AVIATION ACCESSORIES



Here are some of the things you can do with the NEW OF Portable

CONVERT ROUND PILOT HOLES TO THESE SHAPES:

SQUARE

HEX

OVAL

SPLINED

KEYED

Using the CP Portable Broach Gun gives you a completely new technique in broaching. You take the tool to the work. Broach is inserted in round pilot hole and one squeeze of the trigger forms and finishes the hole. The broach pulls a clean. "mirror finished hole, every time to ± .0002" accuracy. Self-contained CP Power Cell weighs only 58 pounds operates on shop air lines and furnishes oil pressure up to 7,000 psi.



Clecomatic No. 10 Series Screwdriver-Nut-Runner: These are the tools that enable you to set torque to the most critical specifications . . . then forget it. Torque is positively maintained by a no-drift locking device. A long wearing, non-friction clutch is quickly adjusted when torque change is desired. This is the only torque control air tool that starts and stops automatically! Operator merely engages the screw with bit, the tool starts. When torque is reached, the tool stops. Motor operates only during rundown. Less air is used. Wear is reduced. There is no quality let-down at the end of a shift because control is in the tool. This tool has little impact, is shorter, and weighs less than competitive tools. No. 10 Clecomatic Screwdriver-Nut-Runners are available in pistol grip or straight handles in speeds from 400 to 2,900 r.p.m. Reversible or non-reversible.

Clecomatic Right Angle Nut-Runners: You get uniform tightness in every nut or bolt rundown with a Clecomatic 14 or 16 Series Nut-Runner. Torque is preset. When specified foot pounds are reached. air is automatically shut-off at the driving spindle. The hazardous, tiring torque kick usually found in tools of this type is substantially reduced, your operators can produce more without extra effort. As for maintenance, there's practically none. Cleco's non-friction clutch operates for very long periods, completely maintenance free. Torque adjustment is made externally, no need to disassemble the tool. Clecomatic Nut-Runners are available with both recessed socket heads and double-end spindles (reversible). Speeds range from 250 to 1,000 r.p.m.

NOW AVAILABLE! Clecomatic No. 6 Series Screwdriver—Nut-Runners: Essentially the same tool as the Clecomatic No. 10 Series—but smaller and lighter. No. 6 Series is equipped with the same unique torque control principle. The same automatic start and stop mechanism. They enable you to make even greater cost savings in the production line operations of automotive, aircraft, appliance, and electronic industries. Clecomatic No. 6 Series Screwdriver—Nut-Runners are available for delivery.



AIR TOOLS

To find out how big an improvement a Clecomatic can make in your operation, call your local Cleco® representative for a tryout-demonstration. For detailed literature, write:

A Division of REED ROLLER BIT COMPANY P. 0. BOX 2119 . HOUSTON 1, TEXAS

IN CANADA: Cleco Pneumatic Tool Company of Canada, Ltd. 927 Millwood Road, Leaside (Toronto), Ontario

* Trademark



Tames tough steels. Gears from one to 300 inches in diameter are machined by Chicago Gear. Steels up to 375 Brinell hardness are worked. STANICUT Oil 208 BCS helps them do it. STANICUT 208 contains maximum amounts of

New, large capacity New Britain bar machines

If you feel you know New Britain bar machines like a book, a word of caution: There's a completely new book! New, basic design that removes limitations formerly inherent in bar machine construction. New power, new speed, completely new capability for imaginative tooling.

And new, large bar capacity. That is the important "new" we want to call to your particular attention here. You can apply New Britain standards of productivity to bar stock as large as 51/8".

The new, big line of four-, six-, and eight-spindle models:

Model 450. Four spindles, 51/8" maximum capacity, four independently operated radial cross slides.

Model 635. Six spindles, 3½" capacity, with independent radial cross slide in every position.

Model 826. Eight spindles, 25%", capacity. Six independently operated cross slides with the two lower slides exceptionally wide to provide elevating blocks for cross slide tooling in the number 3 and 8 positions.

Inexpensive, disc-type cams provide positive actuation of cross slides. Cross slide and end-working tools on all models are easily accessible. All models have positive spindle carrier lifting, locating and locking. New catalog material will give you further details on these machines. Your New Britain representative can show you how the increased profitability built into them can improve your competitive situation. Plan to see him soon.

THE NEW BRITAIN MACHINE COMPANY

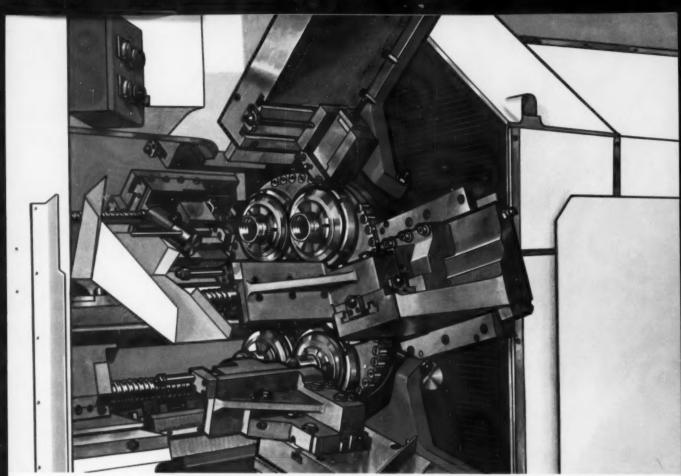
Capacity up to 15" on New Britain chuckers

We are going to take it for granted that you take New Britain chuckers for granted—as the leading make of multiple spindle automatics. Most people do. The big news then is that the profitability of these famous machine tools can now be applied to an increased range of work. The new New Britains are available with chucking capacities up to 15", which enables you to apply New Britain standards of speed, accuracy and versatility to larger work.

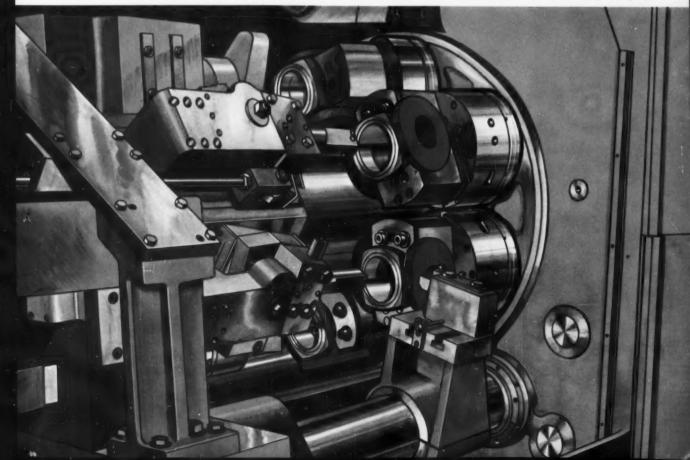
The 15" capacity applies to four-spindle models. Six-spindle machines will take pieces up to 12", and eight-spindle chuckers will handle up to 10".

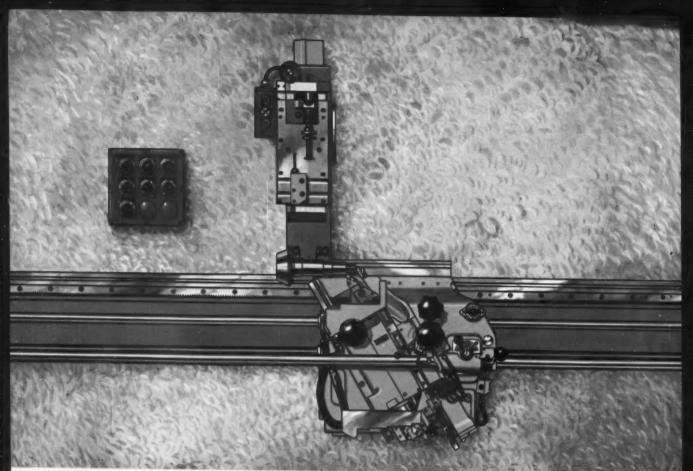
If you work with large castings and forgings, this might be the announcement of the decade, in terms of an investment that can't fail to be profitable. With equipment like this properly adapted to your particular requirements, nobody, anywhere, is going to trim you on cost per piece.

Call on your New Britain sales engineer for practical, specific information, of course. Meanwhile, we have just published a new catalog on these new large capacity chuckers, and we would be happy to mail your copy to you on request. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

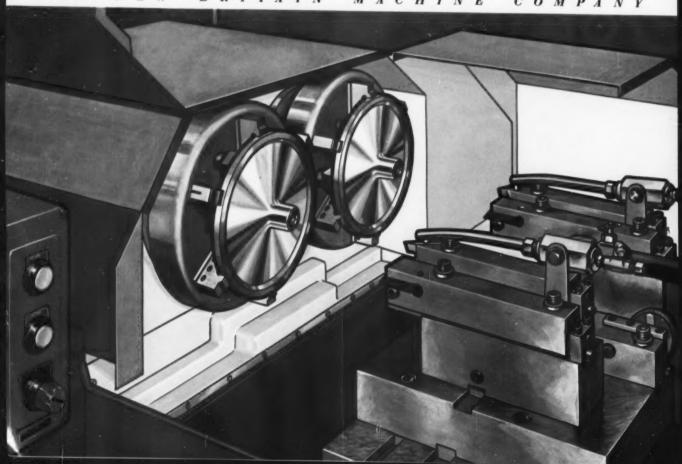








THE NEW BRITAIN MACHINE COMPANY



Fast, rugged New Britain +GF+ copy lathes

Right from the ground up the New Britain +6F+ is a machine conceived, designed and manufactured as a copying-contouring lathe. Not a standard lathe with copying attachment; not a factory-made "special" with the contouring feature built on components from other lathes; but a solidly based, ruggedly constructed, fast, powerful, accurate machine designed solely for the template-controlled, rapid production of between-centers or chucked work with external or internal contouring.

A million pieces or just a few, it's a machine you'll use on many different types of short-run jobs (just change the template and reset the controls), or on one long-run job (just replace the single-point tool when it wears).

The instantaneously accurate hydraulic copying

mechanism is entirely enclosed within the compact carriage. All controls are within easy reach. The template is up front for easy adjustment. The chips fall free into the wide open base, can't clog or iam any part of the mechanism.

There are endless variations available within the New Britain +6F+ line. The standard model has applications anywhere on between-centers or chucked pieces. Other attachments and models are available to suit your particular requirements; infeed attachments, automatic loading, bar stock models, etc.

Don't buy any lathe or "special" for copy turning until you have investigated the New Britain +6F+ copy turning lathe. As a starter, may we send you the latest catalog?

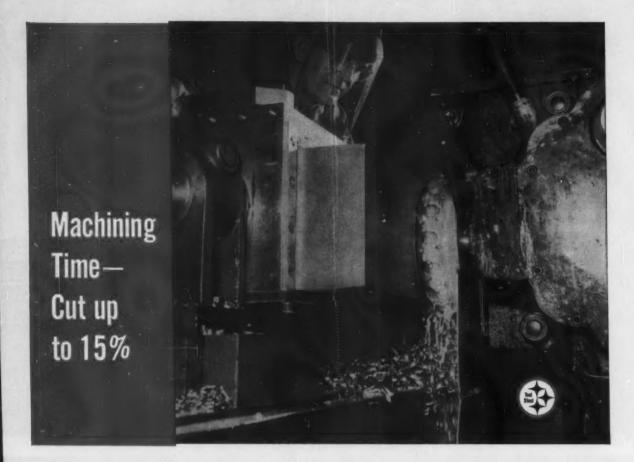
NEW BRITAIN . GRIDLEY MACHINE DIVISION

Consistent accuracy to tenths at super speeds

Model 37 Precision Boring Machine is a machine with a mission, rather than an answer to everybody's metal turning problems. Its mission is contour boring and turning in applications where both extreme repetitive accuracy and high production are of paramount importance. If you have such a requirement, Model 37 is an unbeatable money-maker.

It is an inherently simple machine: simple to operate, with inspection limited to gauging any one dimension. Simple in operating principle, too, built around precision cams that operate without being affected by temperature fluctuation. From one to four high speed spindles can be mounted on a single machine.

We would be happy to discuss any production problem involving straight or contour boring and turning. We doubt that anyone equals New Britain's know-how in this area, and we have a wide variety of boring equipment, both vertical and horizontal and of very advanced design. No matter what your work, or production requirements, this is a very fine place to look for an answer. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Dependable DESEGATIZED® FM Die Steels

... easier to work ... easier to machine

In the production of thousands of metalworking dies, the properly dispersed alloy sulphides in Latrobe's FM High Alloy Die Steels have permitted increased feeds and speeds—machining time cut up to 15% in most cases! This cost-saving production is possible with no sacrifice of the excellent toughness, wear resistance and hardenability properties of the steel.

FM die steels are produced by Latrobe's Desegatized process of manufacture. This process guarantees full structural uniformity of the steel—an even distribution of the all-important carbide particles and "free-machining" alloy sulphides—your assurance of dependable quality.

Four grades of 12% chromium FM steels are regularly stocked: Olympic FM (type D-2) for long-run applications; BR-4 FM (type D-7) for extreme abrasion resistance; GSN FM (type D-3) for severe non-deforming requirements; Cobalt Chrome FM (type D-5) for extra resistance to galling and pickup.

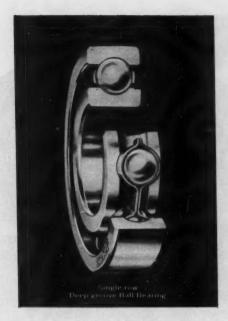
For better die steels and technical service, call your nearest Latrobe representative. Literature on grades available upon request.

Skillfully made in U.S.A.



LATROBE STEEL COMPANY LATROBE, PENNSYLVANIA

BRANCH OFFICES and STEEL SERVICE CENTERS: BOSTON • BUFFALO • CHICAGO CLEVELAND • DAYTON • DETROIT • HARTFORD • LOS ANGELES • MIAMI • MILWAUKEE NEW YORK • PHILADELPHIA PITTSBURGH • SAN LEANDRO • TOLEDO



Can a standard bearing offer you "more bearing" for your money?

It can if it's made by BEF-because all BEF bearings, both ball and roller, offer special qualities at "production" bearing prices.

Take the single-row deep-groove ball bearing featured here, as an example. ASF designs and builds this type to sustain heavy radial load and thrust load in either direction. Furthermore, it is engineered to run smoothly and quietly at normal speeds with grease lubrication—and at high speeds with oil.

Yet this is a standard BOSF ball bearing, mass-produced by automated production equipment at our plant at Altoona, Pa. You can quickly get this bearing in over 100 sizes, ranging from 5%" to 15.748" O.D., and in a variety of seal, shield and snap-ring combinations.

But why not find out what BESF offers in bearing quality, availability and economy? Just call the BESF branch office nearest you.







Tyson^o Tapered





Thrust Bearing



Milford Rivet & Machine Company reports ...

Precision Parts Ground 20 TIMES FASTER when put on the No. 18 Blanchard

"408 precision washers, in one chuck load, now surface ground in same time as 20 by former method . . . substantial savings on all other Blanchard-ground jobs . . . finished work quality outstanding . . . former sub-contracted jobs now done at less cost in our own shop . . . operator fatigue practically eliminated . . . maintenance is very low."

Are you missing opportunities like these by not using Blanchards on your surface grinding jobs? Write for your copy of "Work Done on the Blanchard"

THE BLANCHARD MACHINE COMPANY 64 State Street, Cambridge 39, Mass., U. S. A.



W-1177



WITH .. MOHAWK STANDARD SUBLAN

Mohawk Standard Sublands are the modern answer to combination tooling operations that mean greater production savings.

Why stock heavy inventories of expensive drilling tools for consecutive operations when just one-pass with a Mohawk "standard" will do the job ...

better, more accurately and economically?



If you want fast, one-tool control, positive concentricity, lower hole costs, less scrap, fewer jigs and fixtures and smaller tool inventory . . . you really need Mohawk Standard Sublands. They're available, right now, from local distributor and/or factory stocks in every size, type and combination for fast, offthe-shelf delivery.

Send for your Copy... of the new Mohawk "Standards" Catelog. Lists all prac-tical sizes, types plus easy method of de-Lists all practermining your needs





Regular Taps, Fluteless (non-cutting) aps, Pipe Taps. Tap Drill and Body Clearance for crews and Bolts.

TOOLS, Inc. Montpeller, Ohio

world's largest producer of Sublands

Metallurgical Memo from General Electric

General Electric announces pre-honed **CARBOLOY** inserts



Hand-honing is inaccurate, and time-consuming-frequently results in premature chipping and breaking.

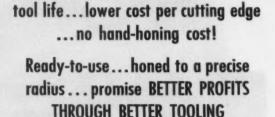
45 MACHINE CHAMFER

Chamfered, or ground-flat, edges are geometrically weaker than a radius and are more easily chipped or broken.

Unhoned or as-ground inserts show rough edgesresult in unpredictable tool life due to chipping.



Shown here, both under magnification and graphically, is an edge of the new Carboloy pre-honed insert. Radius is geometrically ideal to minimize chipping, extend tool life many times.



Now you get more predictable

Now General Electric Carboloy inserts are pre-honed at the factory! Here's what it means to you:

- 1. An insert with edges honed to precise radii gives the strongest geometric shape to withstand cutting pressures. This reduces chipping increases the predictability of tool life. Hand honing cannot achieve precise radii G-E pre-honing can . . . and does!

 2. Since chipping is minimized, fewer cutting edges
- are wasted. The result is lower cost per cutting edge.

 3. Since inserts come pre-honed and ready-to-use, the labor cost of hand honing is eliminated. This more than offsets the charge for pre-honing.
- 4. Pre-honed Carboloy cemented carbide inserts have standard edge radii honed to a greater or lesser degree, depending on the job to be done. You'll know the honing is right!

Ask your Authorized Carboloy Distributor about pre-honed Carboloy inserts, convertible seats, tool-holders, and brazed tools. Or, write: Metallurgical Products Department of General Electric Company, 11147 E. 8 Mile Street, Detroit 32, Michigan.

TOPS IN TOOLING QUALITY

From the research and quality-control facilities of the Metallurgical Products Department of General Electric comes the outstanding quality tooling line in the metalworking industry. The new Carboloy pre-honed inserts, as well as the complete line of Carboloy toolholders, inserts, insert seats, convertible seats, and brazed tooling, are designed to meet every tooling need efficiently and economically.

CARBOLOY

CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL



ELECTRIC

CARBOLOY® CEMENTED CARBIDES

MAN-MADE DIAMONDS . MAGNETIC MATERIALS

Accuracy...fing long tool life high surfa high Accuracy finish surface tool life long



For high production machining operations.

- 1. SINGLE-END Short . . Standard . . Long.
- 2. DOUBLE-END Short . . Standard . . Long.
- 3. TWIN-DRIVE Single-End . . Straight-Shank. Two and Four Flute.
- 4. MULTIPLE-FLUTE Taper Shanks.
- 5. TAPER-SHANKS Two Flute.
- 6. STRAIGHT SHANKS
- 7. BALL-END Single and Double-End.
- 8. CARBIDE TIPPED Single-End.
- 9. SOLID CARBIDE Single and Double-End.
 - . . . There's a STANDARD End-Mill for every job requirement.

STANDARD'S **Authorized Distributors** Stock-ready for immediate delivery-the COMPLETE FAMILY OF STANDARD

QUALITY CUTTING TOOLS, Twist Drills ... Reamers ... Taps ... Diet ... Milling Cutters ... End Mills . Counterborgs ... Hobs ... Carb Tools and Gages.

Take advantage of STANDARD'S experience and know-how in metallurgy and engineering for your metal cutting problems.

Call the STANDARD Distributor in your area.

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AMES DIAL INDICATORS are built by

nonconformists

10 AMES 101 20 30 30 WALTHAM MASS US A 40 101 111 111 111 111 111 111 111 Ames 100 Mismorator Discourant of the contractor of the contract

Ames 100 Series Micrometer Dial Indicator

Some people might be shocked to learn that in this day of automation it takes more than one hundred separate hand operations to build a single Ames micrometer. In many respects we are building and assembling these precision instruments exactly as we did fifty years ago.

Why? Because there are some jobs that can still be done better by a pair of skillful, sensitive hands than by the best automated machinery made. As long as this fact holds true we'll refuse — for your sake — to follow the crowd. For Catalog No. 60 write to: B.C. Ames Co., 27 Ames Street, Waltham 54, Mass. — in Canada, H.C. Burton Co., Ltd., 166 Rebecca St., Hamilton.



Representatives in Principal Cities

B.C. AMES CO.

MANUFACTURERS OF MICROMETER DIAL INDICATORS AND GAUGES ACCU-FLOW AIR GAGES • TRANSISTORIZED COMPARATORS



54







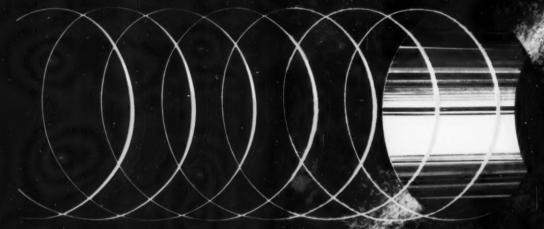
LINE BORING

STUB BORING

COUNTERBORING

ANGULAR BORING

FACE MILLING



END MILLING

ANGULAR MILLING

DRILLING

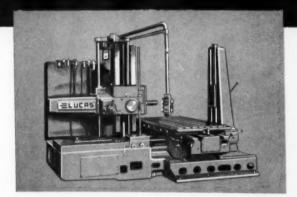
REAMING

TAPPING

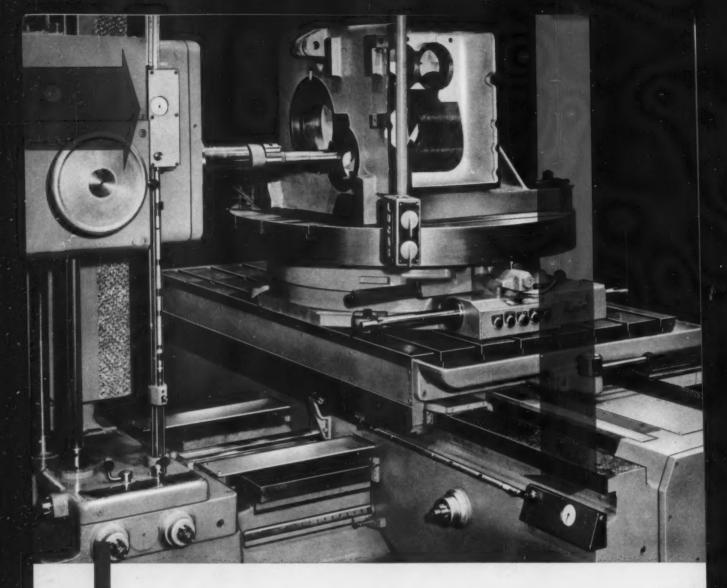
THREADING.

Automatic power positioning with Lucas precision

For production or faster completion of a single piece: locates head and table to predetermined settings for boring operations. No time wasted on jigs or fixtures in drilling, reaming and tapping. Lucas versatility, precision and time saving are the keys to Lucas profitability. Lucas Machine Division, The New Britain Machine Company, Cleveland, Ohio.

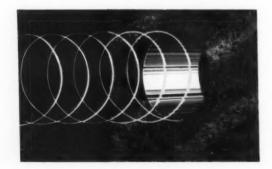


LUCAS OF CLEVELAND



Automatic repeat settings accurate to ±.0001

Lucas Automatic Power Positioning operates at rapid traverse to locate head and table, entirely independent of operating feed rates—thru a system of end measuring rods and micrometer dial indicators. Upon starting the positioning cycle the machine does the precision setting automatically. Would you like a complete Lucas Catalog? Lucas Machine Division, The New Britain Machine Company, Cleveland, Ohio.





RUGGED to full tool capacity!

...FOR LONG WORKING LIFE
TO ELIMINATE DOWNTIME & PRODUCTION LOSSES!



THOMSON

THRIFTMASTER DRILLHEADS









Tremendous economies from the use of multiple-spindle drill-heads are obvious. Use *THOMSON* THRIFTMASTER Drill-heads for optimum performance and profits. *Ask NOW for our new catalog*.



1022 NORTH PLUM ST. LANCASTER, PENNA. EXpress 2-2101

Also Makers of DORMAN AUTOMATIC REVERSE TAPPERS

Subsidiary of
THOMSON INDUSTRIES, INC.

FOR ACCURATE LOCATING USE UNIVERSAL LOCATING PINS

Universal Locating Pins assure quick, accurate locating throughout even the longest production runs. They're hardened and ground to extremely close tolerances . . . precision made to give long service life for much less than the cost of ordinary tool-room pins.

Press fit, threaded or lock-screw types, round or

relieved, are stocked in all standard sizes for immediate delivery. Write for catalog detailing locating pins plus other Universal production tools.



Relieved Press-Fit Pin





OTHER PRECISION-BUILT COST SAVING



ENGINEERING COMPANY, FRANKENMUTH 2, MICHIGAN

Hard Gear Tooth Honing has completed the transition from an engineering research project to its present operational status in less time than any other major development in the field of modern gear practice. Why? Because Hard Gear Honing satisfies a long recognized need more economically than any other known process.

RED RING Has Won Wide Acceptance





USERS

- The aircraft industry
- The automotive industry
- Computing machine manufacturers
- Motorcycle industry
- Tractor industry
- Gear manufacturers
- Electric motor (gear head) industry
- Machine tool builders

GEARS BEING HONED

- Transmission gears
- **Timing gears**
- Change gears
- Computor gears
- Main drive gears
- Motorcycle gears

PURPOSE OF HONING

- To remove nicks and burrs
- To improve surface finish
- To improve noisy gears
- To salvage rejects
- To quickly detect errors in prior machining
- To correct minor heat treat distortions

For complete details on Hard Gear Honing, write for Bulletin H-57-2.



8269

NATIONAL BROACH

5600 ST. JEAN . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

FOR IMMEDIATE RELEASE

Press Release from: JONES & LAMSON MACHINE COMPANY, Springfield, Vermont, U.S.A.

for all publications, on machines for N M T B A Exposition.

J&L's Booth #839 at the NMTBA Exposition in Chicago will include turret lathes ranging from a standard, manually-operated #3 Ram Type Turret Lathe up through an entirely new line of machines with automatic transmissions. Highlights of the J&L exhibit will be an all-new, completely automatic, electro-mechanical machine; and the world's first production model of the Jones & Lamson Numerically Controlled Turret Lathe. Machines will be in operation on actual production jobs.

Among other production-proven turret lathe operations, you will see multiple tooling on a two-dimension turret lathe tracing unit, and the remarkable Jones & Lamson auto-threader, which provides completely automatic cycling for single-point thread chasing.

Moving on to other high production machines, Jones & Lamson will have in operation three different variations of the all-new family of Model 30 Single Spindle Automatic Turning and Tracing Lathes. The basic machine is of bridge-bed design for maximum rigidity, and offers extreme versatility of tool motion, ease of loading and unloading (manual or automatic), as well as ideal conditions for chip removal.

The three machines in operation will be set up as follows: One is a Multiple Slide Single Spindle Automatic (machining a production run of crankshafts). Another is a 60° Automatic Tracing Lathe (performing high-production work on steering knuckles). The third machine will demonstrate multiple tooling of Two-Dimensional Tracing on a series of different sized gear blanks.

All of these machines feature a wide range of spindle speeds (up to 32), with automatic speed and feed change during a cut. A variety of components may be added to the base machine to meet specific requirements demanded by the individual customer's work. For instance, a rugged 6" hydraulic ram tailstock is mounted on the lower bed for between centers work. Multiple tooling may be applied to a rear forming slide, or a rear facing, forming and turning slide - also mounted on the lower bed. Two bevel facing, or necking slides (one light-duty, one heavy-duty) are available for mounting on the front side of the lower bed. The upper bed may carry a multiple-tooled turning slide, a 60° tracing slide, or a 180° (two-dimensional) tracing slide. The two-dimensional slide is hydraulically controlled, and may be multiple-tooled for tracing operations using any one of eight different tool travel cycles - each of which controls tool motions through a full 180° of travel.

Two different headstock transmissions are available (16 speed or 32 speed) as well as two different spindle noses (6" A-1 or 8" A-1). The machine comes in three standard bed lengths - 24", 48", or 72". Controls are unique, reliable and extremely accessible. On re-order, for instance, set-up is accomplished in a matter of minutes simply by setting the graduated dog rings on the conveniently located control drum.



J&L Numerical Tape Control Turret Lathe



J&L 60° Model 30 Automatic Tracing Lathe



180° 2D Tracing on J&L Model 30 Lathe

The new Jones & Lamson automatic form grinders will stimulate some new thinking. Perpetual Form Control (PFC) with cemented diamond cutters will be employed to show the advantages of high production, close tolerance grinding - with no time out for wheel dressing.

A new PFC dresser with up to 12" of width for CDP cutters is one of the features of the new "Model E-3".

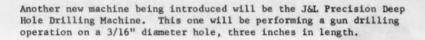
Another machine being exhibited for the first time is the "Model F" Thread Grinding Machine, designed for high-production thread grinding of small parts. It is particularly applicable to thread grinding operations on all standard taps, with manual or automatic handling.

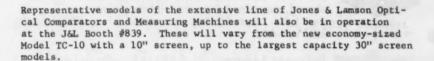


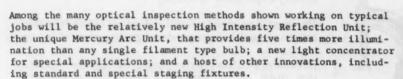
J&L Model F Automatic Thread Grinder

J&L will also introduce a brand-new, low-cost, small, Precision Thread Grinding Machine. Details of this machine are still considered as "classified", but will be released at show time. Watch for it. Originally it was to be designed specifically for satellite shops in the Electronics Industry, but its design has been amplified to include work performed in a larger segment of the metalworking industry.

The Precision Boring Machine is a relatively new member of the J&L line. It is low in price, but high in performance. Single or multiple spindle set-ups are available for close precision turning, boring, or facing operations. One of the demonstrations at the show (an actual production job) features the complete machining of both inside and outside surfaces of stainless steel cups in a single 20-second machining cycle.







J&L's 20" x 20" Positioning Table will also be in operation under one inch, 8 channel tape control, with electronic hydraulic servo control for end point positioning.

The Positioning Table will be set up in conjunction with a Standard Post Drill, to demonstrate the speed, accuracy, and minimum set-up time required with tape control on small or long-run production.

The famous "no approximations" Jones & Lamson thread tool line will also be on display. This line includes Automatic Opening Tangent and Radial Type Die Heads, Collapsible and Solid Adjustable Taps, and the time-saving Modern-Magic chucks and collets.



J&L Double Spindle Precision Boring Machine



J&L Tape Controlled Positioning Table

Advertisement

"The Man Who Needs a New Machine Tool Will Find it in Booth #839"

ARMSTRONG

SET-UP and HOLD-DOWN TOOLS





ARMSTRONG PLANER JACK BRACING JACK VERTICAL JACK

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ARMSTRONG ADJUSTABLE STEP BLOCK



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"T" SLOT NUTS ARMSTRONG WASHERS

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ARMSTRONG SCREW HEEL CLAMP

ARMSTRONG DOUBLE FINGER

ARMSTRONG ARMSTRONG FINGER CLAMP "U" CLAMP

Whatever its shape, a work piece can be quickly, easily and safely set up on any T-slotted table with ARMSTRONG Set-up Tools. Comprising a complete "system" of supporting and holding devices in all essential sizes, ARMSTRONG Set-up Tools usually pay for themselves on the first job and continue to lower costs for years to come.

Save Time: Keep costly machines and high priced men producing—save time otherwise lost while operators rummage in the scrap box for materials with which to devise makeshift set-up methods.

Prevent Breakage and Spoilage-correctly designed, machined from special steels or drop forged and heat treated, they are extremely stiff, strong and reliable.

Increase Accuracy—hold work rigidly and support it fully regardless of shape.

Prevent Accidents—end risk of set-up failure with resulting tool breakage, damage or personal injury.

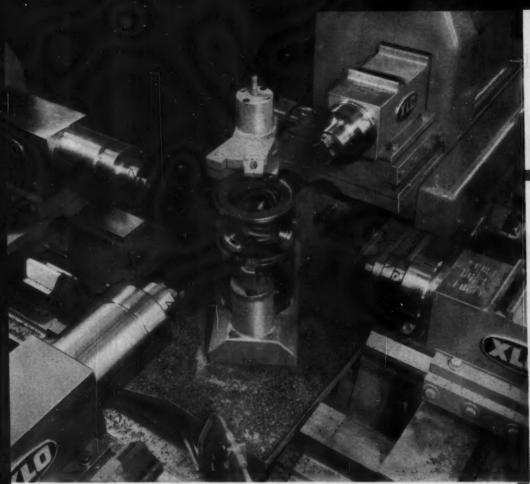
Increase Profits—by reducing down time, increasing man hour output, assuring accuracy, ARMSTRONG Set-up and Hold-down Tools cut costs and build profits. They are part of every properly equipped tool room and shop.

Your Local Armstrong Industrial Distributor carries a good stock of Set-up and Hold-down Tools. He offers you quick, efficient service on these, as well as other, quality ARMSTRONG Tools.



SEE US AT BOOTH 238 PRODUCTION ENGINEERING SHOW SEPTEMBER 6-16 NAVY PIER CHICAGO, ILLINOIS

ARMSTRONG BROS. TOOL CO. 5213 W. ARMSTRONG AVE. . CHICAGO 46, ILL



TYPICAL
"BUILDING BLOCK"
ARRANGEMENT

ONE WAY TWO WAYS AT 180* TWO WAYS AT 90* THREE WAYS MULTI WAYS

4-Way Production Savings with Ex-Cell-O Way Machines

LOWER COST Each Ex-Cell-O "Building Block" Way Machine Unit has standard base, table slide and complete, inbuilt hydraulic system. You can specify only the standard spindles or accessories that meet your present needs. 2 INCREASED FLEXIBILITY One Way-type unit gives you a basic, versatile precision boring machine; as operations become more complex, simply add one or more Way units to a common end section to multiply production or machining functions. 3 MORE VERSATILITY Ex-Cell-O Way Machines permit precision boring, turning, facing or grooving, chamfering or counterboring—with or without automatic cycles, work indexing or clamping. 4 GREATER CAPACITY Using simple fixtures, you can rough or finish-machine larger, heavier work than possible on most standard boring machines.

Ask your Ex-Cell-O Representative about savings with Way-type Machines, rearranged a or write direct for details.

SEE EX-CELL-O'S BOOTH 946, NMTBA EXPOSITION

Typical setup shows four units positioned at 90° for simultaneous rough boring, counterboring and trepanning. Beds, tables, center section, hydraulic systems, controls and Ex-Cell-O Precision Spindles are standard components. Units can be rearranged at any time.

60-25

EX-CELLO FOR PRECISION

MANUFACTURE AS OF PRECINCIAN MACHINE TOO S - BRINDING AND BURNING SPINDLES - CUTTING TOOLS - OBJECT OF THE STATE OF THE ST

EX-CELL-O

new series



"Designated the model 'H,'
our new Jigmil series
provides greater range,
is more rugged, easier
to operate and more
accurate."

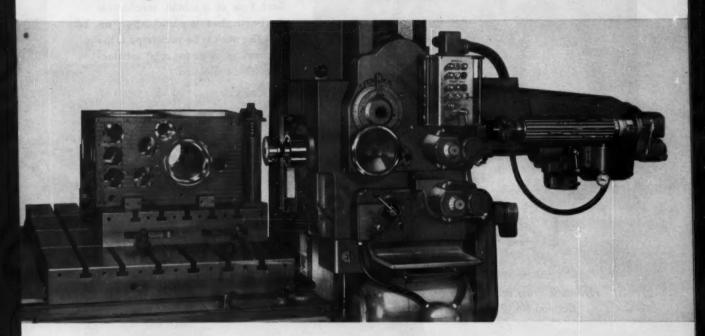
"Available in spindle sizes ranging from 3" to 5", the new 3H, 4H and 5H machines greatly increase Jigmil range for precision boring, milling, drilling and other operations. The new series introduces simplified controls, thermal control of main spindle bearings for increased accuracy . . . wider bed and table for added stability and working range . . . stainless steel way covers for positive protection . . . features that reach a new standard in Jigmil accuracy, ruggedness and simplicity of operation. And like all Jigmils, the 'H' series is available with the DeVlieg Diatrol direct dial dimensioning system or Tapac*—DeVlieg's own system of automatic tape control."

R. A. JERUE Vice President in Charge of Engineering

*Tape Automatic Positioning And Control

"H" Jigmils

with Duplitrol · Diatrol · Tapac





See new "H" series JIGMILS with DeVlieg Diatrol and DeVlieg Tapac in operation at the NMTBA Exposition, Chicago, September 6-16th.

Also, see in operation the new Micropoint Precision Tool Grinder-first grinder capable of absolute control of tool geometry.

DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

STEELWELD PRESS BRAKES

Hydraulic and Mechanical



Press Brake. Bed and ram length

THATEVER your requirements, there is a Steelweld Press Brake -hydraulic or mechanical-to best serve your needs. Available in all sizes to 2000 tons. For plate thicknesses to 2". For lengths to 30'-0".

Each type of machine, mechanical or hydraulic, has its particular advantages. The work to be performed is the determining factor for most satisfactory machine selection.

As a manufacturer of both types of press brakes, we are in a position to offer you either one without partiality. Therefore, we urge you to get the complete story, the Steelweld story, when considering the purchase of a new brake. Ask for free catalogs.

Hydraulic Press Brakes Catalog No. 2024



Mechanical Press Brakes Catalog No. 2023



ISS BRAKES

Steelweld Machinery includes: Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.



STEELWELD MACHINERY DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 5475 E. 281 ST. • WICKLIFFE, OHIO

Booth 1008

MACHINE TOOL EXPOSITION • CHICAGO

See

your formula for tomorrow in action, today...

in Booth 1008—where Kearney & Trecker has filled almost 7000 sq ft with modern machine tools.

There'll be the numerically controlled machine that has created an entirely NEW Manufacturing Concept-the 100th MILWAUKEE-MATIC right off the line . . . the NEW "S" Series knee-type milling machines . . . the famous heavy-duty, "TF" twin-screw, knee-type milling machines ... the Mil-waukee-Mil-bed-type production mills featuring "Dial-A-Cycle" program control and optional tracer control . . . the Model "D" Rotary Head Machines that simplify complex machining into a single setup . . . all these and many moreplus factory personnel to answer your questions, and help solve your specific machining problems.

See you at "1008"—The Machine Tool Exposition—The Amphitheatre—Chicagoany day, every day from September 6 through the 16.

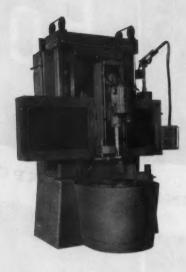
Vertical Universal Grinders

Springfield vertical universal grinders are among the most versatile tools you can use for both production and toolroom work. Head is easily positioned to grind ODs, IDs, surfaces, offsets and undercuts in any combination, generally with one chucking. Work may be regular or irregular in shape, up to 48" high with up to 52" swing on standard machines. Weight of workpiece is no problem because gravity works for you in vertical grinding — helps achieve extreme micro-inch finish and concentricity.

A typical example of a Springfield's remarkable precision is its ability to grind taper valve plugs and seats with one angle setting of the head—and get 95% blue or better on a taper gage with surface finish smoother than 30 RMS.

For high production, sometimes involving automatic loading, cycling, size control and unloading, Springfield builds special vertical grinding machines. Most of these can be reset when part changes occur. Another area in which Springfield has pioneered is in vertical contour grinding machines that handle missile parts.

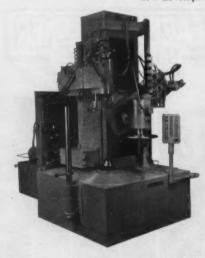
If you would like to know more about Springfield vertical grinders, please write for Bulletin 197-G.



model 3-TR 52" swing



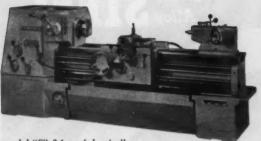
new developments coming!



vertical contour grinder

SPRINGFIELD

The Springfield Machine Tool Company Springfield, Ohio



model "S" 24 useful spindle speeds, 66 feeds & threads heavy duty 16" medium duty 20"



new developments coming!



model 280 16 useful spindle speeds, 60 feeds & threads heavy duty 14", 16" medium duty 20"

The Springfield Machine Tool Company Springfield, Ohio

Engine & Toolroom Lathes

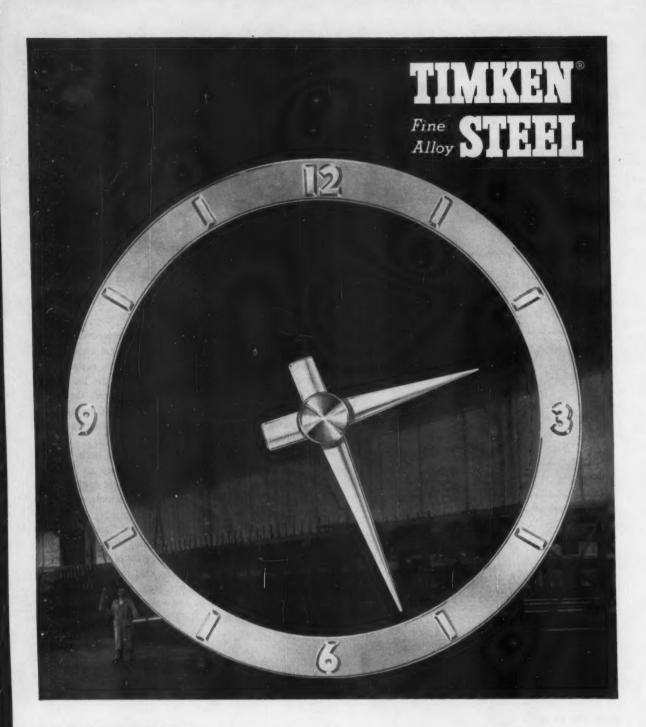
Springfield lathes have 10, 15 or 20 horsepower motors for heavy cuts, and have simple, practical features that keep the operator productive and keep the maintenance man away. Pressurized mist lubricates the headstock. Only four gears are in mesh for a given speed—the others run free. Clean, functional design and simplified controls promote pride of workmanship and minimum waste motion.

Ruggedness with precision has always been characteristic of Springfield lathes—because they are built to one standard of excellence. A Springfield engine lathe meets the accuracy standards set up for toolroom lathes—without any cost penalty.

Whenever you want maximum power and efficiency, and the cost designed out by designing simplicity in, consider a Springfield lathe. A full range of attachments is available—hydraulic contouring and reproducing, plain and universal relieving, taper, etc.

If you would like to know more about Springfield lathes, please write for Bulletins 190-G and 201-G.





ANY TIME is the right time to order Timken® 52100 steel tubing. We'll ship within 24 hours from our new warehouse. 101 sizes of tubing are available, ranging in size from 1" to 10½" O.D. with a wide selection of wall thicknesses. It's handy to use when you need less than mill quantities, too! We can also give you extra fast delivery on 51 sizes of nickel-moly tubing. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "Timrosco". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

THREAD GRINDING COSTS TOO HIGH?

Here's How a Modern Ex-Cell-O can Increase Production and Lower Your Labor Costs



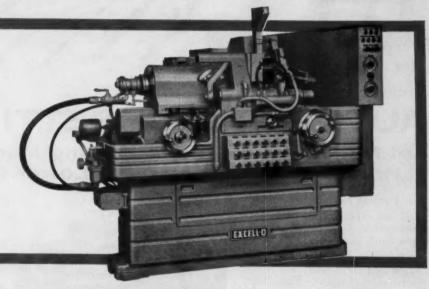
1939—Style 39 Ex-Cell-O Internal Thread Grinder, then the fastest of its kind, produced 17 automotive steering gear ball races per hour. It had power wheel dresser, automatic dresser compensation and automatic wheel feed.

1946—The part's the same, but the manufacturer has turned to a postwar Ex-Cell-O Style 39-A Precision Thread Grinder with fully automatic grinding cycle, including automatic wheel dressing at predetermined intervals. Operator simply loaded the part, reset the size handwheel and pressed the start button. Production increased to 24 parts per hour.



1960—Modern Style 39-A, today produces the same basic part but now at a rate of nearly 60 parts per hour. This powerful, versatile machine has a high-speed workhead, high-frequency Bryant Grinding Spindle, automatic loading, unloading and cycling. It requires only the part-time attention of one unskilled operator.





SEE EX-CELL-O'S BOOTH 946, NMTBA EXPOSITION

TOMORROW—Will you have a similar long-run part, or perhaps pinions, worms, taps, thread gages, lead screws, missile components or other special parts that cannot be rough- or finish-ground economically on your present equipment?

Your local Ex-Cell-O Representative can show

you how modern Ex-Cell-O Precision Thread Grinders can substantially reduce the cost of producing a wide variety of your large and small threaded parts. Call him today, or write direct for details on the complete line of Ex-Cell-O Internal, External and Universal Thread Grinders for every toolroom and production job.

60-35

EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS - GRINDING AND BORNE SPIROLES - SUTTING TOOLS - BRILL JIE BUSHINGS - TOROUS ACTUATORS - CONTOUR PROJECTORS - GARES AND CARINE SOURF-MENT - GRANITE SURFACE PLATES - ATOMIC ENERGY EQUIPMENT - TALKOOD VINE AND BUSHINGS - DAILY AND OTHER PACKAGINE EQUIPMENT

Machinery Division

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CORPORATION

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AUTOMATIC UPSETTING!

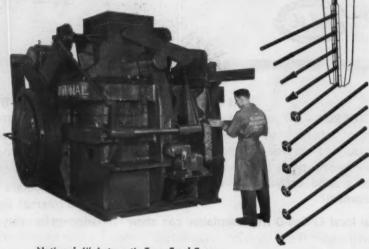
Let National Tong-Feed Forging Machines Produce Your Forgings at Lower Cost

Hot Forging is going automatic! Well, not all of it, but many forward-looking forge plants are taking a fresh look.

For example, all of the upset-type forgings above were made on National Automatic Tong-Feed Forging Machines. Seven sizes are now proved and presently operating in production: 1", 11/2", 2", 3", 4", 6" and 71/2".

The method offers extremely interesting opportunities of raising production while reducing labor and operating costs. May we help you investigate?

Let's start by looking over your jobs, preferably here in Tiffin. Here we can have a productive session devoted entirely to your plans, but without obligation.



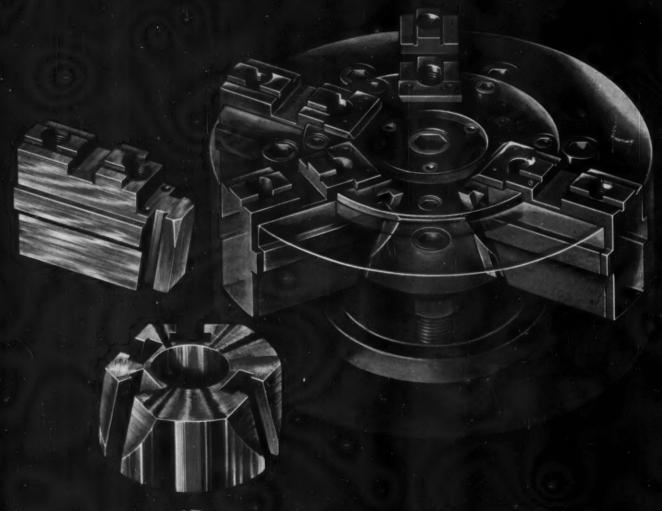
National 4" Automatic Tong-Feed Forging Machine with discharge conveyor.

Founded 1874 - DESIGNERS and BUILDERS of MODERN FORGING MACHINES . MAXIPRESSES . REDUCEROLLS . COLD HEADERS BOLTMAKERS . NUT FORMERS . TAPPERS . NAILMAKERS CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING PRODUCTION METHODS HARTFORD

TIFFIN, OHIO, U.S. A.

DETROIT

CHICAGO

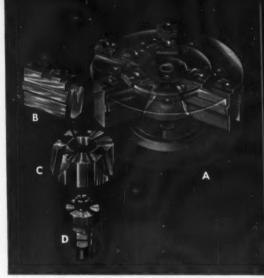


one chuck
with
two or three jaws

SKINNER DUAL PURPOSE POWER CHUCK

One Dual Purpose Power Chuck saves the cost of an additional chuck

Skinner dual purpose standard power chuck is designed with four master jaws so that it may be used as a two or three jaw chuck. It is no longer necessary to pay for one chuck to machine round work, and an additional chuck to machine odd shapes and castings. Not only do you save the cost of an additional chuck but you get all of the advantages of Skinner power chuck design listed below. Skinner dual purpose power chucks are available with adjustable, non-adjustable, or serrated jaws, in sizes 8" to 36".



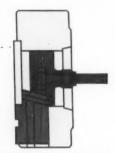
A—Transparent view of dual purpose power chuck B—Master Jaw C—Wedge D—Drawbar Stud and Wedge plug

Skinner wedge-type chuck offers these advantages

- · Allows automation of long production runs.
- Reduces operator fatigue—air performs the muscle work.
- Adjustable gripping pressure—air pressure can be adjusted for light or heavy chucking—is not left to the judgment of the machine operator.
- Work can be gripped internally or externally.
- Assured continued high accuracy because of wedge design (see illustration).
- Reduced wear because of hardened parts—models available with flame hardened center hole and jaw locks.
- Complete line—heavy and light duty models in sizes from 4" through 36".



Wedge at top of stroke jaws fully open (External gripping)



Wedge at bottom of stroke jaws fully closed (External gripping)

The wedge and three jaws—only four moving parts—operate as a collet does with accuracy maintained over the whole range. The wedge angle is 14° which was found to be the most efficient angle for maximum power and jaw travel. With this wedge construction, the grip of a Skinner power chuck holds as set—even if the air line is broken—until opening power is applied in the opposite direction.

Skinner Power Chuck Accessories



Double-Acting Rotating Air Cylinders for use with power chucks and fixtures provide maximum pressure with a minimum amount of air. Cylinder walls are burnished to provide maximum sealing life. Cylinders in sizes 6 to 18 with semi-steel bodies are designed for low speed operation.

Aluminum body cylinders in sizes 4 to 20 are designed for high speed operation.

Packaged Power Chucking Assemblies are available for Atlas, Cintilathe, Hardinge, Logan, Regal, Sheldon, South Bend, and many similar lathes. Assemblies are also available for Brown & Sharpe and similar automatic and hand screw

machines to permit chucking of cold drawn parts, small or odd shapes and castings. Packaged assemblies consist of chuck with two or three jaws, threaded drawbar or drawtube, rotating air cylinder, cylinder adapter and necessary mounting for the individual machine.

dividual machine.

Power Chuck Fixture, air or hydraulically operated, holds work for drilling and milling machines and for other bench and machine

A Complete Line of power chucking accessories includes hand, foot, and solenoid valves, drawbars, air units, and soft blank top jaws.

installations. Available in many jaw types in sizes 5" to 36".

For complete information about the Dual Purpose and other power chucks and power chuck equipment, contact your Skinner Representative, Distributor, or write us at the address below.



SKINNERCHUCKS

THE CREST OF QUALITY

THE SKINNER CHUCK COMPANY . NEW BRITAIN, CONNECTICUT, U.S.A.



Some Comments on Actual Production Efficiency



"One machine does the operations formerly done on 29 different machines."



"New Multicycle hobbing machine increases production while maintaining versatility."



"Special W. F. & John Barnes Machine Solves Production Line Problem — Inspects 36 Cylinder Block Oil Holes Automatically."



"New Quick-Tilt Spindles Can Increase Your Grinding Production 50%."



"Saves 33% hourly cost, 15% total production time on this job."

See the machines that make these benefits a reality at the

MACHINE TOOL EXPOSITION - 1960

International Amphitheatre in Chicago...September 6-16

ROCKFORD INSERT GROUP

Keep gathering metal-working production ideas . . . be well informed when you replace machinery...

Simplified cross-slide camming Interchangeable cross-slide tool holders Quick-adjusting stroke mechanism Rapid speed and feed changes Wide-open, easily reached tooling area Built-in threading feed and drive Easily accessible main toolslide holders

eight big reasons why you get

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on GREENLEE BAR AUTOMATICS

In plant after plant countless hours of setup time are saved each year on Greenlee Bar Automatics. Similar savings in time and money can be achieved in your own plant. Greenlee has on-the-job case studies to prove it. Whether your responsibility lies in the field of management . . . production . . engineering . . . or purchasing you owe it to yourself and your company to call in the Greenlee man. Let him show you why and how faster setups on a Greenlee pay off in greater profits



Stationary type collets

changed quickly

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4-SPINDLE...6-SPINDLE SECOND-OPERATION PNEUMATIC STOCK FEED



GREENLEE BROS. & CO.

1892 Mason Avenue Rockford, Illinois

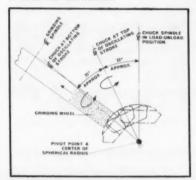


Grinds spherical surface of bevel pinions automatically at 260 per hour



Here's peak pinion production with precision—and it's all automatic!

This special Mattison spherical surface grinder removes .008" to .015" stock from the back faces of SAE 1022 differential pinions at the net rate of 260 per hour—holds a form tolerance of .002" on the radius.





Spherical seats are generated as the pinion simultaneously revolves on the work spindle and oscillates about the center point of the desired radius (Fig. 1). An 80 grit, 24" dia. wheel cuts at 6500 sfm, with work rotating at 210 rpm and oscillating past the wheel. Eight passes finish a pinion.

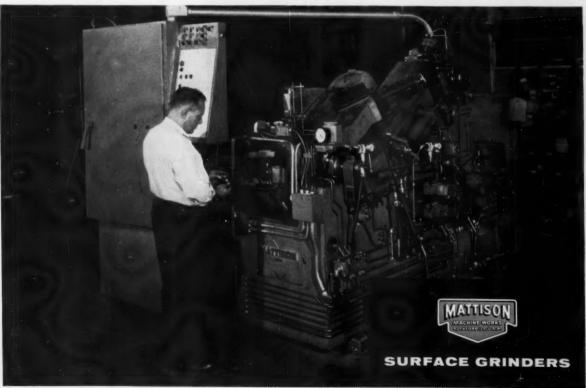
Automatic wheel dressing and wear compensations speed production

The wheel is self-dressing after initial concave forming by a simple swing-type diamond dresser mounted on the wheel slide. Wheel-wear compensation is controlled automatically by an air gage, which actuates the feed mechanism in .0002" increments.

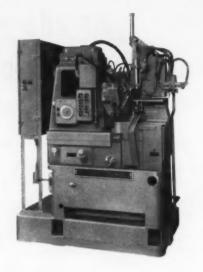
As the wheel slide feeds to the end of its plunge stroke, a limit switch actuates a time-delay relay, allowing the wheel to dwell and true the work surface. A three-second sparkout dwell completes the cycle.

Here's automatic grinding in command of peak production! For details on how special grinders can increase production of *your* key parts, contact your Mattison representative or send prints and production requirements to:

MATTISON MACHINE WORKS
Rockford, Illinois Phone WOodland 2-5521









Compact, high-speed hobbing machine combines many advanced principles of gear cutting... for manual operation or complete automation

Whether yours is a general-purpose gear shop or an automotive plant requiring high-volume production, Barber-Colman's new No. 4-6 vertical hobbing machine can give you total gear-cutting economy — low tool cost, faster cutting, increased machine utilization.

Here, in a compact vertical, is the perfect combination of high speed, rigidity, versatility, and automaticity . . . carefully built to Barber-Colman's recognized high standards of precision and extra quality.

High capacity in a versatile machine

Automatic cycling of the No. 4-6 includes carriage feed, retraction after the cut, and rapid carriage traverse to the starting position. Combined high speeds and minimum non-productive time between cuts make decreased cycle times a practical reality. The machine is designed specifically to be tooled for automatic



High Speed, Versatile Hobbing

... with Barber-Colman's new No. 4-6 Vertical Hobbing Machine

loading. However, it is simple to set up and can be loaded manually when required.

As an example, the 12-14 pitch, nine-tooth automotive pinions (AISI 1024) shown here are hobbed at 240 per hour at 100% efficiency, using a 3" diameter x 4" long triple-thread hob. This job has a feed rate of .045" per revolution, and a hob speed of 362 rpm (284 sfm). Total cycle time for each load of two pinions is 30 seconds.

The machine is automatically loaded ... a shuttle places the blanks, two at a time, under the hydraulically actuated tailstock where they are locked in position against the serrated driver. After the cut, the shuttle unloads the finished work and picks up the next set of blanks.

The automatic hob-shifter is an integral part of the automatic cycle. It can be set to operate after each cycle, or after a certain number of gears has been cut. This assures high gear production and low hob cost.

Rugged design increases productivity

Vertical design of the No. 4-6—with integral bed, spindle housing, and upright—provides extra rigidity and simplifies application of automatic tooling. The heavy vertical column rigidly supports all motions of the machine. Movements of the column in both directions are controlled by positive stops. Hydraulic pressure holds it firmly against a depth stop during the cut.



See the new No. 4-6 vertical hobbing machine at the 1960 Machine Tool Exposition . . . Booth 923. Close-couple design, with short shafts having high diameter-tolength ratios, minimizes vibration, even under the toughest conditions. Both the hob spindle and work spindle are mounted in precision tapered roller bearings.

These are reasons why the No. 4-6 can offer you maximum hob speed of 614 rpm and maximum feed of .150" per work revolution.

For complete information on how you can gain total gear-cutting economy, contact your Barber-Colman representative or write the factory direct.

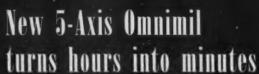
Barber-Colman Compan



82 Loomis Street, Rockford, Illinois



The Sundstrand System of



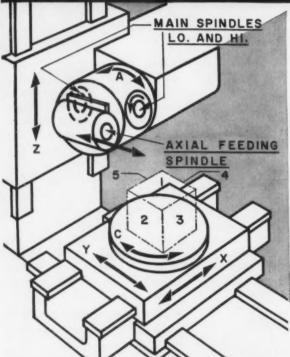
... a one-machine "production line" — handles every operation required on many parts with a single setup.

. . . mills, drills, bores, reams, taps all exposed faces of the workpiece at any angle.

... positions to $\pm .001''$ accuracies.

... performs both point-to-point and contour machining.





Almost unbelievable versatility and cost-reduction potential are provided by the new Sundstrand numerically controlled 5-axis Omnimil.

All machine functions, including optional automatic tool change (not illustrated) are under numerical control. As illustrated at the left, 360° positioning of the workpiece is provided by the rotary table. X- and Y-axis positioning are provided by the table and saddle. The head travels in the Z-axis on the column and rotates a full 360°.

The main head carries two spindles, one for high and one for low-range speeds. These spindles are used with feed applied to table, saddle, head, or any combination of the three. Auxiliary head attached to the main head feeds parallel to the centerline of main spindle.

Machining can be performed at virtually any compound angle on the workpiece, and holes can be drilled, tapped, or bored square in respect to any angular face. Contour machining can be performed by combining any of the 5-axis motions as required.

The Omnimil is one of a complete system of standard and special numerically controlled machines developed by Sundstrand because no one type of machine can be best for every requirement. The machines illustrated at the right typify the range of the line.

Ask for a Sundstrand "Engineered Production" analysis of your operations — and be sure to visit Sundstrand at the Machine Tool Exposition, Booth No. 1014.



SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS . DIVISION OF SUNDSTRAND CORPORATION



Machinery, August, 1960

MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.

Numerically Controlled Machines









2-axis, 20" x 30" Sundstrand Jigmatic positioning table placed under existing machines,

such as radial drills, eliminates jigs, positions accurately to ±.001"



A moderately priced machine with 2-axis positioning of work consists of one or

more vertical heads on a simple frame above a Sundstrand numerically controlled Jigmatic table.



New machine with rail-mounted turret head and 40" x 60" table handles work-

pieces too large for the Jigmatic table. All motions, including turret rotation, are numerically controlled.









3-axis machine with railhead and 20-position numerically controlled tool changer

brings new efficiencies to drilling, milling. Table size is 40" x 60".



3-axis machine for boring, drilling, reaming, tapping, and milling. Available with

numerically controlled index fixture boring, reaming, tapping, and light which presents all four sides of the workpiece to the cutting tools.



Sundstrand "Engineered Production" machine designed to mill locating spots on six

different crankshafts. The basic components are standard. The spindle and workpiece are numerically positioned.







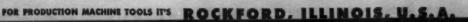














How well are you investing

THIS INDUSTRY STANDARD —

MODEL OG SHAPER-PLANER 32" x 24" x 66"

COSTS ONLY 521,896!

Model OG 32" x 24" x 64" including one railhead, hydraulic and electrical equipment

including the "fine print" which reads:

Infinite Speeds and Feeds
Hydraulic-Powered Drive
L-Shaped Crossrail for Maximum Support
Adjustable Sidehead Rail
Non-Derailing Table
Double-Nut Saddle Construction
Adjustable Taper Gibbing
Automatic Tool Lifter

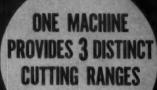
Hundreds of these machines are now in production service, proving the design and efficiency needed for competitive production. Real production efficiency results from low initial cost, high performance rating, and minimum maintenance required.



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FOR WIDE-RANGE FLEXIBILITY —

MODEL OGN SHAPER-PLANER with h3 Drive



for optimum efficiency

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medium range to 150 fpm . . . for average cuts in medium steel and cast-iron.

high range to 300 fpm . . for carbide planing of steel and non-ferrous metals.

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Analyze your metalworking capital expenditures, and then see these advantages demonstrated at:

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HOW TO MACHINE Universal Joint Spiders AT LOWER COST

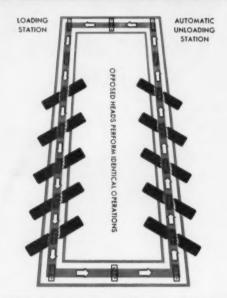




Positioning in Transfer Fixture Permits Straight-Through Operations, Conserves Space

Here is another example of how W. F. and John Barnes special machine engineering has effected a substantial reduction in production costs. By combining operations on two ends of four parts at each working station, universal joint spiders are drilled, chamfered, and hollow milled in a continuous cycle at a gross rate of 766 pieces per hour. Positioning and clamping of parts in pallet-type transfer fixtures permits straight-through operations without unclamping or re-positioning the workpieces. Rough broaching the forgings is the only preliminary operation.

A further refinement in the machine design includes power clamping of parts in fixture and automatic unclamping and unloading after machining operations are completed. Pallets are then returned to operator at the loading station. This same principle can be economically applied to a wide range of similar parts. Modifications in machine design can be made to suit individual production and cost requirements.







Barnes 17-Station Return Transfer-Type Machine processes universal joint spiders at gross production rate of 766 pieces per hour. Over-all floor space 2576 square feet.

View of pallet pusher-type transfer fixture equipped with clutch drive screws for automatic clamping and unclamping of 4 workpieces.

Builders of Better Machine



ASK FOR AN ANALYSIS OF YOUR PRODUCTION METHODS

For assistance with any production machining job we suggest you call in Barnes engineers and ask them to assist you. Your production problems will be closely analyzed and given expert attention. All design and engineering as well as manufacturing facilities are coordinated at Barnes to help you solve problems quickly and efficiently.

Write for Free Brochure

Describes Barnes complete 6-point coordinated machine tool building facilities. Individual bulletins are also available describing and illustrating a wide variety of special drilling, boring, and tapping machines as well as special automation equipment.

W. F. & JOHN BARNES COMPANY

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Multiple Spindle Drilling · Boring · Tapping Machines · Automatic Progress Thru Transfor-Type Machines





HOW MUCH COULD YOUR SHOP PRODUCE IN A TWO HOUR DAY...

... LESS A COFFEE BREAK?

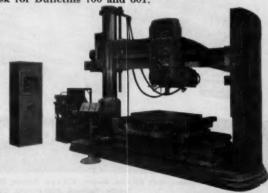


Almost as much as you now produce in 8 hours with conventional equipment! When you switch to an AMERICAN numerically controlled Positioning Table and the new AMERICAN Hole Wizard Radial Drill, your production will step up 400%!

In addition to fast, error-proof positioning to ± .000250", the AMERICAN positioning table gives you extreme ease of operation. The simply loaded punched tape is read by low pressure air, and automatically moves the table to first position at the touch of a button. After that, your operator need only touch the "Next Position" button on the portable console.

This rugged, profit-making combination was designed by American Tool Works and Sperry Gyroscope engineers to increase your production, eliminate expensive jigs, prevent operator error. Ask your American Distributor about "Toolease," our leasing plan under which this AMERICAN Positioning Table and AMERICAN Hole Wizard Radial combination can improve your production... while it pays for itself. Or, write Section 163 at the address below.

Ask for Bulletins 700 and 801.





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Designed To Do More Jobs... Produce More Work ... Save More Production Time and Cost

Proved, definitely, as the cutting tool for the die-sinking industry, T-J now offers an expanded cutter line for the precision milling of today's high speed, high production manufacturing. The new line has been designed to do more, as well as add to individual cutter life. Cutters feature a high helix angle, double back-off, right or left hand spiral, and flats on the shanks for set screw type chucks. Write today for Catalog No. 259 and complete details to The Tomkins-Johnson Co., 2425 W. Michigan Ave., Jackson, Mich.

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Fosmatic 54 P Precision Boring Machine with tape control of saddle, table, spindle, head and automatic tool changing

new

Grinder with preselect dial control and automatic positioning

Fosmatic 44 PG Jig

Fosmatic 32 PG Jig Grinder with automatic positioning

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5 BM Sensitive Drill with variable speed transmission

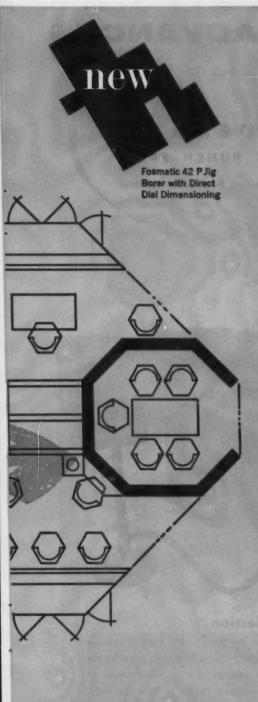
new

6' 17" Fosmatic Radial Drill

Sensitive Two-axis Drill-numerically controlled

new

5 BM Sensitive Drill with gear transmission



See Foodick in action at the Machine Tool Exposition, Chicago, September 6-16.





In the show BOOTH 800

Rest your tired production worries here.

Chasing that elusive last ten-thousandth inch? Here are machines guaranteed to work to that 4th decimal place on a production basis. Now Fosmatic Precision Boring Machines are completely automatic, with numerically controlled saddle, table, spindle, head, and tool changer. This is NEW. See them at The Show, Booth 800.

Now famous Moore-Fosdick Jig Grinders have automatic positioning and numerical control. This is NEW. See them at The Show. Booth 800.

Now Fosdick has Numerically Controlled Drilling Machines, versatile and fast. Here's an end to a frozen investment in drill jigs and fixtures. They're NEW. See one at The Show. Booth 800.

Drilling speed like you never saw before, with a battery of tools at the command of a button. It's yours with Fosdick's brand NEW Turret Drill. See it in Booth 800.

And that isn't all that's new. Come to booth 800 and see for yourself.

Get a proposal from Fosdick.

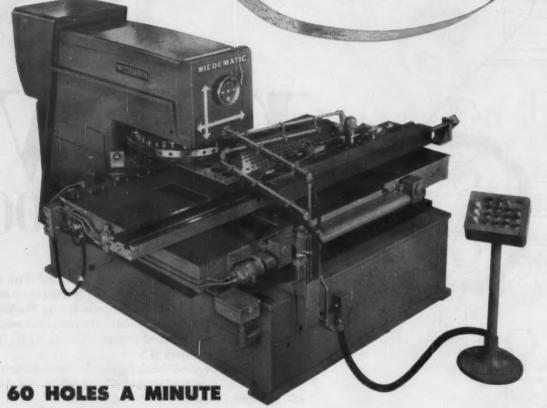


THE FOSDICK MACHINE TOOL COMPANY
Cincinnati 23, Ohio

SEE THE BIG ADVANCES

WIEDEMATIC TURRET PUNCH PRESS

with Numerical Positioning Control



with Automatic Work Positioning and Tool Selection

SEE the Wiedematic position and punch holes of many sizes and shapes automatically in actual production runs of sheet metal and plate parts.

SEE how all press operations are controlled with amazing speed and accuracy by an easily prepared punched tape. SEE how the Wiedematic Method reduces production costs 60% to 90% and provides the key to major savings in every other phase of your operations from design to final assembly.

Be sure to see the Wiedematic in operation

— Booth 1249 at the Machine Tool Exposition.

WIEDEMANN

WIEDEMANN MACHINE COMPANY DEPT. M-8 • GULPH ROAD • KING OF PRUSSIA, PA. International Amphitheatre Chicago, Ill. • September 6-16

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WIEDEMANN TEMPLAMATION

Making Full Use of Low Cost Templates For Fast, Accurate Piercing

SEE how Wiedemann Templamation employs templates to ensure occuracy and reduce piercing costs.

SEE how high accuracy, templates are made rapidly on the COORDINATOR . . . inspected without guesswork on the direct reading INSPECTOR . . . then used for positive work positioning on a WIEDEMANN Turret Punch Press equipped with a high speed follower gauge.

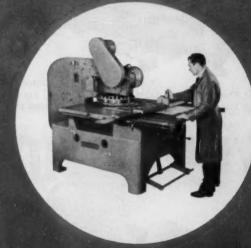
SEE how Wiedemann Templamation gives you many of the advantages of automation with manually operated machines.



1. TEMPLATE IS MADE ON THE WIEDEMANN COORDINATOR



2. TEMPLATE IS INSPECTED ON THE WIEDEMANN INSPECTOR



TEMPLATE IS USED FOR HIGH SPEED HOLE POSITIONING ON THE TURRET PUNCH PRESS

Other Wiedemann Turret Punch Presses will also be in operation.

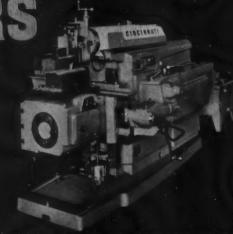
WIEDEMANN

THEN HEAD FOR THE FAR CORNER—BOOTH

RIGID SHAPERS

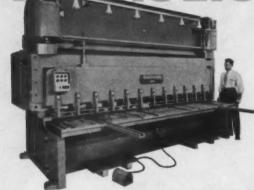


Fast and accurate metal removal will be exhibited by the Cincinnati 24" Rigid Shaper—see it cut 2" deep at .030" feed.



This 16" Cincinnati Duplicating Shaper demonstrates automatic tracing from a simple sheet metal template.

HYDRAULIC AND MECHA



This new $\%'' \times 12'$ Cincinnati Hydraulic Shear, with adjustable rake from 0" to %'' per foot, will cut from relatively thin sheets up to %'' mild steel plate.



Check the fast, accurate sheet shearing performance of this Series 1410 Cincinnati Shear $(\frac{1}{16}" \times 10')$ mild steel capacity) equipped with a magnetic sheet support.

HYDRALLIC AND MECHA



Don't miss seeing both plate forming and punching on this Cincinnati Series 750-H x 16' Hydraulic Press Brake. Fast set-up, long stroke and deep throat make it especially profitable for fabricators who produce varied shapes in plate.



The 3 Series x 10' Cincinnati Press Brake, 75 tons near bottom of stroke, has all the Cincinnati refinements: all-steel construction, centerline loading, rigid, microcrowned bed and ram, motorized ram adjustment plus many other features.

All in action at

CINCINNATI BOOTH 1230 SHAPER®

Machine Tool Exposition - 1960, Chicago, International Amphitheatre, September 6-16

NICAL SHEARS

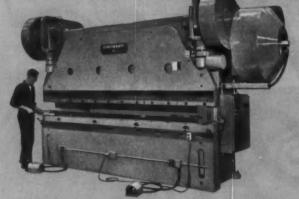


Speed up your plate cutting jobs with Cincinnati mechanical plate shears, represented by this Series 4312 Cincinnati Shear ($\frac{1}{2}$ " x 12' mild steel capacity).



See this new Cincinnati Hi-Speed Shear cut 18 ga. x 24" coiled stock at 200 strokes per minute. Used in conjunction with automatic coil-feeder-straightener.

NICAL PRESS BRAKES



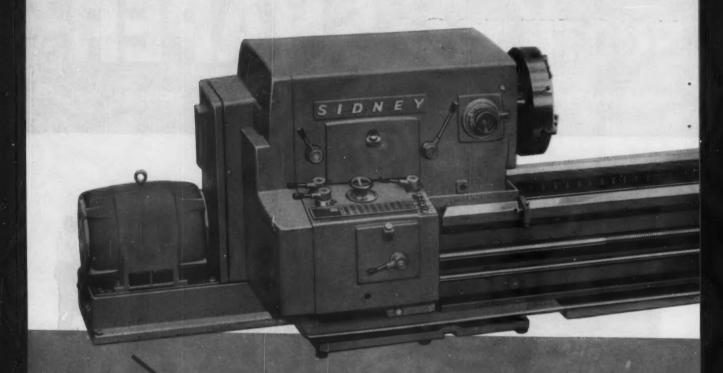
The new 225 ton, 9 Series x 10' Cincinnati Automatic Cycle Press Brake demonstrates high-speed sheet metal forming without "clutch-slipping," "whip-up" or "back-bends." See the first real solution to high speed production with automatic bending action.

THE CINCINNATI
SHAPER ...

Cincinnati 11, Ohio, U.S.A.

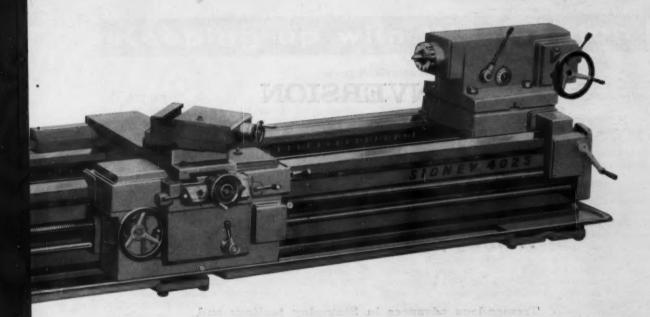
In Scotland: The Cincinnati Shaper Co., Ltd., Glasgow

A GREAT OLD NAME



SIDNEY 4025

GETS MEW GLORY



AN ALL-NEW LATHE FROM THE FLOOR UP

Now! From one of the most respected names in the machine tool industry comes a completely new lathe, the Sidney 4025. The extra heavyduty 4025 is a product of Sidney's years of experience plus extensive research among lathe

users to determine the features most wanted in a lathe. The result is an all-new lathe which removes metal faster, easier and at lower cost on a wide range of jobs. Here are just a few outstanding features of the new Sidney 4025:

75 HORSEPOWER IN ALL SPEED RANGES makes possible a metal removal rate of up to 180 cubic inches per minute. This extra power gets the job done faster and at lower cost.

DUAL CAM TUMBLER LOCK FOR GEARBOX eliminates the possibility of gear and cone gear unlocking during exceptionally heavy feeds. Gearbox also provides 60 threads and feeds for greater versatility. SPEED RANGE OF 5 TO 800 R.P.M. permits the selection of a surface speed to handle a larger variety of work or materials. The Sidney 4025 can achieve a 22 to 26 micro inch surface finish.

THREE DIMENSIONAL TRUSS DESIGN OF BED gives exceptional rigidity to handle the torsional load of the full 75 horsepower. The one piece bed also features replaceable hardened and ground tool steel ways.

SIMPLIFIED CONTROLS located at a convenient height for the operator provide faster, easier operation. Spindle controls consist of a single dial and shifting lever for either r.p.m. or surface speeds.

DEPTH READING DIAL measures tailstock spindle travel to eliminate possibility of operator error. Operator-selected live or dead spindle is optional for maximum control and versatility.

PLUS...Anti-friction bearings throughout, automatic lubrication, and many other exceptional features. For complete information contact your local Sidney Distributor or write directly to:

SIDNEY MACHINE TOOL COMPANY . SIDNEY, OHIO

SIDNEY, OHIO / A WHOLLY OWNED SUBSIDIARY OF BUHR MACHINE TOOL CO.

SEE THE SIDNEY LATHES in action at the National Machine Tool Exposition, September 6 thru 16, Chicago. Booth 1440.

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Tremendous advances in Stamping toolings and techniques have made possible the conversion to Stampings of many complex parts previously produced by casting or forging. Foremost in the development of these advances are specialist-engineers of the Stampings Division here at The Laminated Shim Company, Inc.

Rocker arms, for instance. Step washers. Belt pulleys. Intricately contoured units for the tractor and automotive industries. Parts like these, and many others previously cast or forged, now may be stamped...in production quantities with improved functional characteristics... with greater accuracy... with the reduction, even elimination, of secondary operations... faster... and at less cost.

Conversion to Stampings may open profitable, new horizons for you. Send us your prints for comments and quotes—for the price of a postage stamp you can have our experienced engineering counsel plus recommendations that may do a better job and save important dollars. No obligation, of course.

tampings DIVISION SINCE 1913

- Machine Tool Standardization Program Launched
- Capital Spending to Continue
- Air Force Reports Alloy Cutting Data



Keeping up with Washington

Loring F. Overman

THE DECISION to name a joint coordinating committee that will direct a program of standardizing general-purpose machine tools has been announced by the National Machine Tool Builders' Association. At press time for this column, committee members had not been named; however, it was decided that the committee should include three builder representatives and three representatives of user groups.

Since the standardization program is not an official function of the NMTBA (although the association is taking an active part in its organization and operation), builder representation on the joint committee will include two members of NMTBA and one nonmember.

Ludlow King, NMTBA executive vice-president, explained that the new standardization committee will consider a program for the unification of industry standards that will facilitate the interchange of tooling and fixturing among four classes of general-purpose machine tools. On the agenda is the proposal for a standard nomenclature which would establish a common identity and specific size for various machine tools, regardless of make.

The program will not influence the design features peculiar to each machine tool builder's product; neither will it inhibit or restrict creative engineering development for future requirements. It will, however, minimize the premature obsolescence of many expensive tools and fixtures, and eliminate higher costs caused by increased application requirements.

Capital Spending to Continue

Capital goods spending at an annual rate of \$39,000,000,000 is forecast for the fourth quarter by the Commerce Department and the Securities and Exchange Commission. This, coupled with an expected \$37,500,000,000 rate for the third quarter will lift the 1960 total to the \$37,000,000,000 estimated at the beginning of this year. The decline to a \$35,000,000,000 rate during the first quarter suggested that the year's estimate might have been too high, but subsequent gains are expected to wipe out the deficit that was feared.

Although spending forecasts in the general classification of "plant and equipment" are encouraging, direct action in machinery ordering and capital installation appears to be lagging a little behind the trend. Washington analysts observe that manufacturers seem to be getting set for production increases, but they are withholding any announcements of the production equipment they will use until nearer the time for starting actual operations.

Observers report a lack of urgency in placing machinery orders. Unlike some previous periods when industry hurried to replace war-worn machines, or to fill shortages in production lines, today's purchases seem to be mainly in cut-cost, increase-efficiency types. Meanwhile, established production lines hum along at a satisfactory pace,

permitting industry a breathing spell to appraise tomorrow's needs.

The encouraging interpretation of this situation is that machinery and equipment planning is on a long-range basis. Should this trend continue, the machine tool industry will be less subject to spasmodic stop-and-go influences which upset day-to-day business operations.

Air Force Reports Alloy Cutting Data

Problems which machines will encounter in shaping twenty-five alloys required by the Air Force are summarized in a new report of Air Force sponsored research. The report covers responses of the alloys to such cutting operations as grinding, turning, milling, tapping, and drilling. Average power requirements for cutting are listed in tables, while thrust force and torque measurements for drilling under various conditions are graphed. The report may be ordered from the Office of Technical Services, Department of Commerce, Washington 25, D. C. Send \$6 and ask for PB 161369, "Machining Characteristics of High Strength Thermal-Resistant Materials: Phase 2—Interim Engineering Report No. 6."

GSA Requires Procurement Notification

Again Washington is endeavoring to turn the spotlight of publicity on its purchasing procedures. The latest rule by the General Services Administration is a new regulation requiring that proposed government procurement in excess of \$10,000 be publicized promptly in the Department of Commerce publication: "Synopsis of U. S. Government Procurement, Sales and Contract Awards." The requirement applies to both advertised and negotiated purchases. Further, the regulation requires agencies to encourage government contractors to publicize opportunities to subcontractors that result from government contract awards.

The new regulation, GSA explained, is intended to encourage increased competition for government contracts, and thus benefit the American taxpayer. Wider distribution of subcontract work can also assist small business and depressed industries in areas of labor surplus. Broadening and improvement of the mobilization base through increasing the number of potential suppliers is another goal. The "Synopsis," published five days a week by the Commerce Department, is available at its field offices. Yearly subscription price is \$10.

Use of Webb Export Associations Suggested

The possibility of having small companies enter the export field through export cartels (permitted by the Webb Act without danger of antitrust action) has been suggested. Under this act, small companies in like industries may export through a Webb association arrangement, sharing costs of promotion and sales, and allocating orders among themselves.

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Machinery

AUGUST 196

Miniaturization and Machine Tools



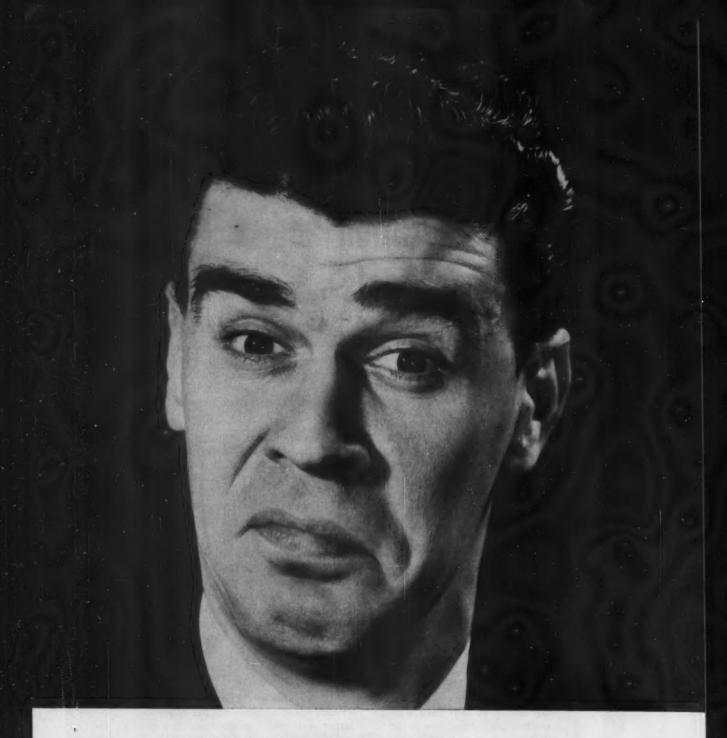
A PHENOMENON of considerable proportions has appeared over the metalworking horizon during the last several years. It is called "miniaturization," a term which refers to the endless variety of very small parts that are required in electromechanical devices such as missile-guidance instruments, transistor equipment, servomechanisms, and computing machinery.

This is a manufacturing area that is certain to expand greatly in the years to come. There are new scientific concepts almost daily and with them seem to come increased demands for even smaller mechanical and electrical parts. The term "subminiaturization" is now in frequent use. Ball bearings, for example, are being made less than 1/16 inch on the outside diameter and using balls only 0.015 inch in diameter. Tolerances specified on many of these minute parts are as close as a few millionths of an inch.

Miniaturized and subminiaturized parts have presented certain manufacturing problems in addition to that of attaining extreme accuracy. One serious problem has been to find "scaled down" machine tools for efficiently producing some small-sized components. All too often, the available machine tools are much larger than necessary. An internal grinding machine has been specifically developed for work of this character and also a bench model indexing type of drilling machine. Within the last month a turret lathe of miniature proportions has been introduced on the market. There are also other types of machine tools of proper proportions.

But, anyone visiting machining departments in electronic plants cannot fail to be impressed with the fact that many components are made on machine tools from five to ten times larger than would be desirable. It seems that new lines of machine tools are in order for a fast-growing industry.

Charles O. Herb-



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WELDING

important
key to
successful
missile and
satellite
performance

CHARLES O. HERB, Editor

Welds must be so perfect that helium gas

—second lightest of known elements—cannot escape
at any point on an air-space vehicle

POLARIS fleet ballistic missiles and Agena satellites are products of the Missiles and Space Division of the Lockheed Aircraft Corporation, Sunnyvale, Calif. As most of MACHINERY's readers know, the Polaris is a solid-propellant inertially guided missile capable of being launched from submerged or surfaced submarines and also from surface ships. It is one of the nation's most successful space vehicles, as evidenced by the fact that of fifty-five test missiles discharged up to March 25 of this year, there were thirty-eight fully successful flights, fifteen partially successful flights, and only two downright failures.

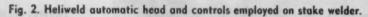
Agena satellite is a space vehicle of which the designers and producers can also be justifiably

proud. This satellite was first put into orbit on February 28, 1959, from Vandenburg Air Force Base near Santa Maria, Calif., in the initial launching of the Discoverer series of satellite firings. Altogether there were six successful launchings of Agena satellites into orbit last year. Their combined weight was 9700 pounds. Contrast this record with but one satellite launched by the Soviet Union last year which had a weight of only 614 pounds!

There are, of course, various factors involved in successful flight of space vehicles both from the design and the construction viewpoints. One of the most significant, however, is the quality of the welds required in building up the various



Fig. 1. Stake welder which produces longitudinal welds on cylindrical and tapered components up to 10 feet in diameter and 12 feet in length.



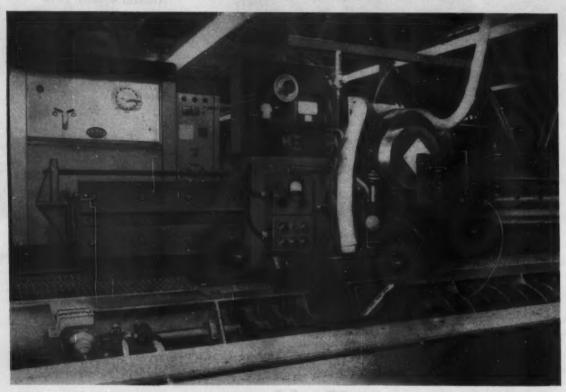




Fig. 3. Huge boom type welder which runs on track 50 feet long used for work held in five positioners located at the sides of the track.

sheet-metal components. On the more important chambers, such as integral tanks, the welds must be so perfect that helium gas cannot seep through at any point. Stringent inspection procedures guard against such a contingency. This article will describe some of the outstanding welding operations in the Lockheed Sunnyvale plant.

Missile and satellite components of cylindrical or conical shape are generally welded along longitudinal seams on the stake welder shown in Fig. 1. This equipment derives its name from its stripper stake design. Components are generally produced from aluminum and magnesium sheets ranging in thickness from 0.040 to 0.160 inch thick. Argon or helium gas, or a combination of the two, is used.

A close-up view of the Airco welding head and controls on the stake welder is shown in Fig. 2. The edges of the part to be welded are located on long electrode bars in the floor of a pit that is seen in the foreground and securely clamped to the bars by fifty-six shoes, twenty-eight on each

side. These shoe type clamps are actuated by individual pneumatic cylinders. Parts up to 12 feet in length and 10 feet in diameter can be handled. Once a job has been set up, the operation is performed automatically.

In order to unload a finished job, the operator turns a crank at the right-hand end of the equipment illustrated in Fig. 1. This releases a hinged support which is then swung upward. The work can then be withdrawn endwise from the welding area.

The most versatile equipment in the department is the huge Airco boom welder shown in Fig. 3. This welder can be positioned anywhere along a track 50 feet in length. Five welding positioners located on both sides of the track can be set up with work and serviced by the boom welder. A typical setup is shown in Fig. 4. This is a tank constructed principally from HM 21 magnesium.

Although the boom welder is employed mainly in making circumferential welds, it is also ap-

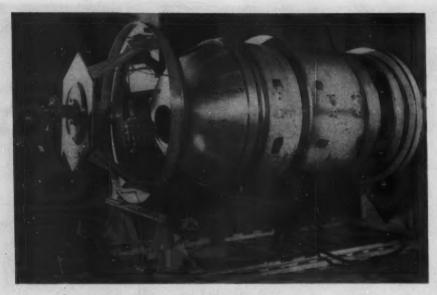


Fig. 4. Tank for Discoverer missile set up for being welded so perfectly that helium gas cannot escape through seams.

plied for longitudinal welds. In the latter type of operation, the boom with the welding head on its front end is fed forward from the column. The horizontal movement may be up to 10 feet in length. In addition, the boom may be fed up or down on the column, a total distance of 5 feet from a point 4 feet above the floor—in other words, to a height of 9 feet for welding vertically in straight lines or for positioning the welding

head at the desired height for a circumferential welding operation.

Finally, the welding torch can be fed radially with respect to the boom through the provision of an elbow manipulator. This permits the extension of the boom end through a hole in the dome of, say, a tank of the design in Fig. 4, and feeding the torch to a point in line with an internal seam to be welded. The torch can then be fed radially

Fig. 5. Welding operation being performed on a tank dome by the big boom welder.

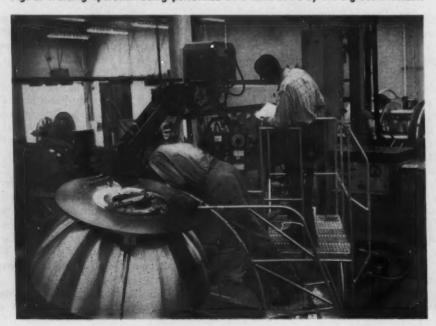




Fig. 6. Another view of the operation in Fig. 5 which shows a typical welding fixture that promotes welding performance.

outward to the seam (a distance of 30 inches) and the welding performed without the operator's actually seeing the arc or the seam. Micro switches insure the accuracy of welding torch positioning in such invisible operations. This arrangement enables the welding together of two hemispheres to form a single complete sphere and eliminates the need for a complicated internal fixture such as would otherwise be required.

Another critical operation performed by the boom welder consists of laying weld metal at the bottom of a narrow slot that extends completely around Y-rings approximately 5 feet in diameter. The slot is only about 1/4 inch wide and 1/4 inch deep. Obviously, the electrode must be positioned at the bottom of the slot and then fed around the large circle. Both the boom and stake welders have a capacity in excess of 300 amperes.

Fig. 7. Missile throat member on a welding positioner. Location of clips on inside surface can be observed.



ICE FOZED MMEL LY

Fig. 8. Spot welder being used for welding a series of clips on the inside of a dome. Fixture of narrow steel strips insures proper clip location.

Figs. 5 and 6 show close-up views of the boom welder being applied for performing an important operation on a tank dome. In this operation, as well as all others performed in the shop, the work is held on a special fixture. The fixtures insure proper support of the work and dimensional accuracy of the finished parts. Generally speaking, the diameters of large components must be to size within 1/32 inch.

Tank domes must have a considerable number of small clips welded to the inside as indicated in Fig. 7. This work is performed on Sciaky three-phase Mode-Wave spot welders as illustrated in Fig. 8. The spot welders have a rating of 200 kva and are built with a 60-inch throat. A fixture constructed of curved narrow strips of steel insures correct location of all clips. These welders are equipped with Deckatron controls.

New Cold-Wall Brazing Furnace Passes Tests at Boeing

Impressive results have been obtained from tests with a new cold-wall brazing furnace at the Wichita, Kan., division of Boeing Airplane Co. The improved furnace for the brazing of honeycomb structures has just emerged from extensive trials demonstrating its flexibility and adaptability. It was designed and tested by the company's manufacturing research section. The new approach will provide an important capability in brazing stainless-steel honeycomb for high-speed vehicles of the future.

A prototype of the furnace was built some time ago, and pilot runs have since been made to test for its ability to handle a wide variety of shapes and structures. Main features of the coldwall unit include placing of the heating elements next to the structure being brazed, the addition of a cooling system, and elimination of costly metal envelopes for each part. The new furnace gets its name from the fact that its walls remain

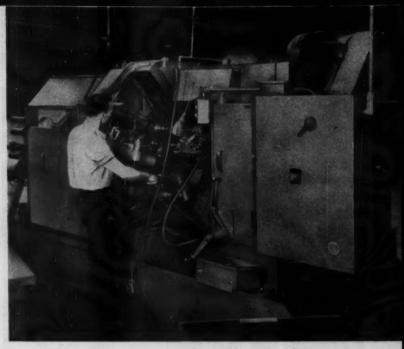
relatively cool during the brazing operation due to relocation of the heat source.

Work is placed on the steel base of the furnace table. It is surrounded by insulating material, graphite tooling, heating elements, and a heat-exchanger cooling system. Above this is a portable steel retort suspended from an overhead track. When the retort is lowered over the work, it rests on an O-ring in the base to make an airtight fit. When the seal between the retort and the base is completed, air is pumped out to create a near vacuum. Purging of the space (to reduce oxidation) is done by argon gas.

Because the heat is concentrated where needed, some test panels have required only 21,000 Btu, compared with 1,500,000 Btu needed for similar panels in conventional brazing. The complete cycle time for purging, brazing, cooling, and unloading is approximately one-tenth of that previously required.

CAMSHAFT BEARINGS MADE BY UNIQUE AND EFFICIENT METHODS

ALBERT J. MASON



Centrifugal babbitting, centerless boring, and inside-out punching of oil-holes are featured in the manufacture of automotive camshaft bearings. Combining these processes with other operations on modern machine tools has resulted in highly efficient production

A COMBINATION of modern and unusual methods are employed by the Dura-Bond Bearing Co., Palo Alto, Calif., to manufacture "all-round" (without split or interlocking joint) camshaft bearings for automotive applications. These bearings, most of which are used as replacement parts, consist essentially of steel tubing to which a lining of babbitt bearing metal is bonded. They are precision machined by the company to 0.0001-inch tolerances in hundreds of sizes.

A solid and continuous bond between the tubing and bearing material can only be obtained on a clean steel surface. Before babbitting, therefore, the tubing is cleaned in molten caustic, rinsed in water, and pickled in an acid solution. Pickling produces a lightly etched surface which mechanically helps to retain the babbitt in the tubing. This is in addition to a metallurgical bond achieved when the molten bearing metal cools.

The lining of babbitt is cast inside of the prepared tubing by an exclusive method. After being coated with flux, a 5-foot length of tubing is placed on the vertical spindle of special automatic centrifugal casting equipment developed



Fig. 1. Here, a 5-foot length of steel tubing is being lowered into a tank of molten babbitt. As the tubing is withdrawn it is rotated and a cooling spray is applied to the outside, causing a dense lining of babbitt to adhere to the inner surface.



Fig. 2. The babbitted tubes are rough-bored, chamfered, faced, and cut to bearing lengths in bar automatics. As two cutoff and loading stations are provided, two rough-bored parts are produced at each indexing of the machine.

by the company. This machine first lowers the tube into a deep pot of molten babbitt. When almost completely immersed (Fig. 1), the tube is rotated and removed at a controlled rate. As the spinning tube is withdrawn, a cooling spray of water mist in an air jet is played on the outer surface, causing a dense layer of babbitt to be cast on the inner surface. The thickness of the babbitt lining is controlled by the rate of withdrawal from the molten metal, the rotational speed of the tube, and the amount of spray—a method perfected by the company.

The babbitted tubes are then rough-machined and cut off into individual bearing lengths in New Britain-Gridley automatic bar machines. A recently acquired eight-spindle bar automatic used for these operations is shown in the heading

illustration and Fig. 2. This machine, which can handle work up to 2 5/8 inches in diameter, has two loading and cutoff stations. Two roughmachined bearings are thus produced each time the spindles index. Operations performed are rough-boring, facing, chamfering, and parting.

Oil-holes are then punched in the rough-bored bearings from the inner surface outward using a die such as the one seen in Fig. 3. This is done to avoid breaking the bond between the babbitt and the tubing, and to insure that no steel burrs will be formed that extend in the direction of the bearing surface. The die shown is set up on an open-back, inclinable Niagara press having a 5 1/2-ton capacity. The press ram has an unusually short stroke (1/2 inch) and stops at the middle of the stroke. In this way, one or more

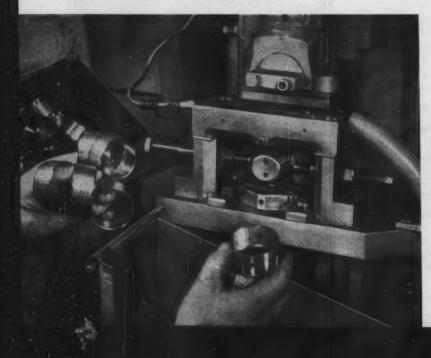


Fig. 3. Oil-holes are punched outward from the bearing bores in this die arrangement. The ram has a 1/2-inch stroke and stops at the center after piercing both top and bottom of bearings. Holes are also punched singly.

holes are punched on the downward half stroke, and one on the upward half stroke. On completion of these operations, the ram centers to allow removal and loading of the work.

Two punch presses having indexing fixtures are used to punch multiple oil-holes around the circumference in the same plane. The bearing is gripped in a collet until two to four holes are completed. In addition, both angular and circumferential oil-grooves are milled in the bearings where required.

After punching, the periphery of the bearings is ground in a Cincinnati centerless grinding machine to within a 0.001-inch tolerance and a 30- to 50- micro-inch finish. An operator is seen loading bearings into the feed chute for the grinder in Fig. 4.

The final boring operation is unique and is accomplished on Heald Bore-Matics in special setups such as the one shown in Fig. 5. These machines have been modified by the company in the following manner: the usual rotating boring tools have been replaced by cast-iron driving rolls on each head, and fixtures, each supporting two idler rolls, have been mounted on the machine frame. The idler rolls retract to allow bearings to be loaded into the fixture at the beginning of the cycle. After the bearings are inserted, an air cylinder pulls the idler rolls up against the driving roll, clamping the bearings in place.

One of the idler rolls has been equipped with a thrust flange which locates the bushings axially and takes the thrust of the boring tool. In addition, hollow boring-bars have been mounted on the work-slides. This conversion results in a centerless boring operation that has enabled the company to hold the bores to a tolerance of plus or minus 0.00015 inch. The bores of bearings having outside diameters from 29/32 inch to 3 1/8 inches and wall thicknesses from 0.050 to 0.442 inch are machined in these special setups. The bearings are produced in hundreds of lengths and diameters, but the wall thickness in the majority of cases ranges from 0.060 to 0.065 inch.

Centrifugal separators are connected to the hollow boring-bars by flexible tubing as shown in Fig. 6. Babbitt chips are removed from the work and deposited in the separators by a vacuum system. This arrangement helps prevent damage to the work by chips, and provides a convenient storage space for them until they are reclaimed by melting.

Fig. 6. Centrifugal separators shown here are connected by flexible tubing to the hollow boring-bars used in centerless boring (Fig. 5). A vacuum system removes the babbitt chips from that operation and deposits them in these separators for later reclamation.

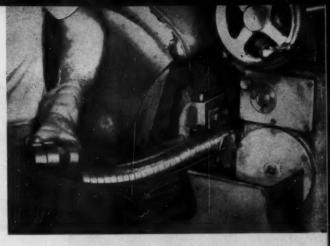


Fig. 4. After punching, the exterior of the bearings is ground on this centerless grinder. Work travels between regulating and grinding wheels on carbide-faced blade.

Fig. 5. Final machining on the bearings is a centerless boring operation. The parts are centered and rotated between a cast-iron driving roll (on each boring head) and pairs of idler rolls. Tools mounted in hollow boringbars on the work-slide perform the finish-boring.





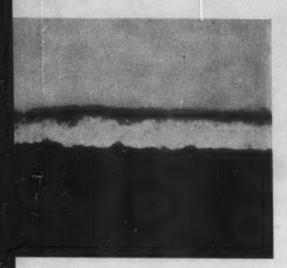


Fig. 1. Protection for high-tensile steel is shown in this photomicrograph (at 825×) of the opaque cadmium coating deposited by vacuum metallizing over a steel surface cleaned by ion bombardment.

Glow-discharge cleaning makes opaque vacuummetallized coating adhere to highly stressed aircraft parts. Hydrogen and chlorine embrittlement are eliminated by a method that bars moisture and galvanic corrosion

CATASTROPHIC FAILURES ELIMINATED BY NEW MASSIVE CADMIUM PROTECTION

LAURENCE W. COLLINS, Jr.
Associate Editor

THE TEST PILOT slams a new jet airplane down on the runway in a wild, "impossible" landing for the tenth time, then calls it a day. The plane, on its still-intact landing gear, is wheeled into the hangar for the night.

Next morning, the "ship" is found listing heavily to starboard. One member of its right-hand landing gear assembly has broken right in two. How, one asks, after standing up to the breakdown tests of the previous day, could the part have failed—just sitting in the hangar? The board of inquiry turns in its report on the incident thus: "Catastrophic failure of hinge resulting from hydrogen embrittlement."

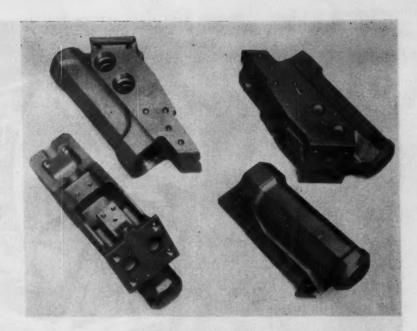
Immediately, the obvious question is: "How do we fight hydrogen embrittlement?" Metallurgists and electroplating engineers have been struggling with the problem of hydrogen embrittlement ever since somebody tried to electroplate a spring. For years the most-used method was the attempt to drive out the hydrogen by baking in an oven after plating. The results were unreliable, even before today's performance standards came into effect, because the baking affected microstructure. The method could not be used on today's high-tensile steels (270,000 psi and

over). The critical situation called for action. Thus, Catalyst Research Corporation of Baltimore, Md., was called in.

The methods long employed by this company for producing heavy vacuum coatings on a production scale were uniquely applicable for deposition of massive cadmium coatings on steel aircraft parts.

Traditionally, when steel is to be electroplated it must be "pickled" in an acid to remove oxides and to activate the surface chemically so that it will accept the plate. Here is where the trouble starts. The pickle, usually hydrochloric acid, reacts with the iron in heat-treated steel, giving off hydrogen. Some of the latter is liberated as gas and some is absorbed into the microscopic pores etched into the metal. Here it may be trapped by the plated deposit. Hydrogen also evolves during the actual plating cycle (most electroplating is from acid solution), exposing the work to the possibility that more hydrogen will be driven into the pores of the metal. The contaminant works subtly along the grain boundaries of the heat-treated steel, and is apparently the source of tiny fissures that upset the stress concentrations in the part. The destructive action, moreover, is

Fig. 2. Hydraulic cylinders for advanced-aircraft wing-tank ejectors are coated with vacuum-metallized cadmium and chromate treated to get a MIL-C-8837 Type II Class 3 finish. Note the number, size, and shape of the cavities that must be covered.



progressive and thus failure is usually not immediate or even predictable. But the threat of failure is always present as the source of cracking or other faults.

Inasmuch as the high-tensile steels used in aircraft are stress-designed to the limit for improvement of the strength-to-weight ratio, it is obvious that no part of the manufacuring cycle be suspect of fault. Hence a continued effort has been going on at Catalyst Research Corporation and other laboratories for many years seeking methods to eliminate hydrogen embrittlement by use of

vacuum-deposited coatings. A prime target was to do away with the hydrochloric acid pickle. But this seemed to rule out cadmium plating, a favorite rust preventive of the Navy and Air Force.

Vacuum deposition of massive coatings of cadmium and other metals has been a regular operation at Catalyst Research Corporation for ten years, but until now the method has been used on highly secret products and thus couldn't be reported. In the research it was learned early that vacuum-deposition methods for decorative vacuum coatings could not be used because the parts had to meet the requirements of Air Force and Navy Specification MIL-C-8837. In order to pass the tests for adhesion under this specification, bonding of the coating to the base metal had to exceed anything ever achieved in intimacy of contact. The successful method developed by Catalyst Research Corporation was the result of producing a surface on the work so free from foreign matter that the vaporized cadmium would adhere to the steel by molecular attraction. Fig. 1, and marks a new concept in metal cleaning. Typical parts are the AISI 4330 steel hydraulic cylinders for wing-tank ejectors, Fig. 2, for an air vehicle built by McDonnell Aircraft Co.

The surface is first vapor degreased, then sand-blasted (Fig. 3) in a "dry room" having an



Fig. 3. Abrasive blast cleans and roughens the steel surface of the cylinders prior to racking on the planetary vacuum-chamber carriage. Although this operation is done in a -20 dew-point atmosphere, the surface must be further cleaned by ion discharge in vacuum before cadmium coating can be effective.

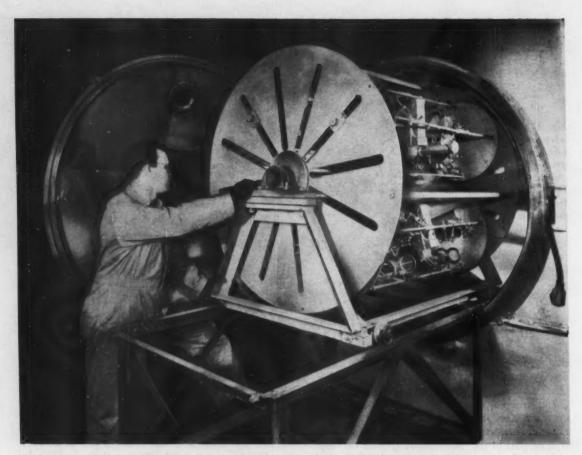


Fig. 4. A planetary carriage loaded with sand-blasted wing-tank ejector cylinders goes into the vacuum chamber. The circular door (behind the operator) will be closed and sealed. Vacuum pump-down will begin with the fixture cages spinning within the larger revolving carriage throughout the cycle.

artificial atmosphere maintained at a dew point of -20. The parts are loaded on a planetary, or "live," fixture (Fig. 4). The jig and the work are next charged into a 60- by 60-inch vacuum chamber, Fig. 5, furnished by F. J. Stokes Corporation of Philadelphia, Pa. Rough "pumpdown" starts after the chamber has been sealed. Pumping continues until a vacuum pressure value of 60 microns of mercury has been reached and out-gassing of the work is well advanced.

At this point a built-in glow-discharge cleaning system is switched on and pumping continues until a pressure of 40 microns is reached. During this time the planetary jig is rotated so that all areas of the work have received ion bombardment from the glow discharge.

Fine pumping is now started and continues until the vacuum pressure reaches 0.08 micron of mercury. At this point radio-frequency power from a Tocco (Cleveland, Ohio) generator is turned on to heat, by induction, the line of six

cadmium crucibles along the bottom of the vacuum chamber. The cadmium soon melts, then vaporizes, with the deposited metal traveling through the vacuum in a characteristically straight, line-of-sight route to the work. The jig turns the work, exposing all surfaces to the cadmium vapor for a period of from twenty to forty minutes, depending upon the depth of coating needed. The rate of deposit is held to about 0.0001 inch of cadmium metal for each ten minutes of exposure. Meanwhile, the maximum temperature of the work is not allowed to exceed 160 degrees F.

After the calculated cadmium thickness has been deposited the crucible heat is stopped. The temperature of the work, the crucibles, and the chamber is allowed to stabilize under vacuum. The vacuum finally is broken by gradual admission of dry air. Then the fixture is removed. For certain classes of military service a phosphate or chromate posttreatment of the cadmium surface may follow. Chromate treatment inhibits water

spotting, and a phosphate treatment improves the adhesion of organic finishes over the cadmium.

With the exception of the glow-discharge cleaning part of the cycle the general method used by Catalyst Research follows the usual pattern for vacuum coating, but the organic undercoating and sealer coatings (as used for decorative work) are omitted. Naturally, the vacuum chamber had to be designed and constructed with provision for the glow-discharge cleaning and also induction heating of crucibles in the bottom. These design changes were modest.

For ion bombardment the vacuum chamber is equipped with electrodes near the walls. The planetary work carriage is driven through a rotary vacuum seal, and the supporting cover plate is electrically insulated from the walls and clamps. Thus the work is charged with negative power (5000 volts at 4 amperes) from the direct-current generator and the rest of the vacuum system is structure-grounded. The direct-current source (Fig. 6) was engineered and specified by Catalyst Research, and the generator itself was designed and built by Westinghouse Electric Co., Pittsburgh, Pa.

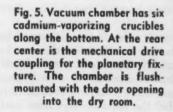
The theory proved by this successful application of ion bombardment is that sand-blast cleaning in normal atmosphere, and even plain vacuum degassing at the required room temperature, is insufficient to permit the required intimate molecular contact of cadmium with the base metal that ensures reliable coating adhesion. But ionic bombardment in vacuum at room temperature gets the results needed, and on a production basis at a reasonable cost figure.

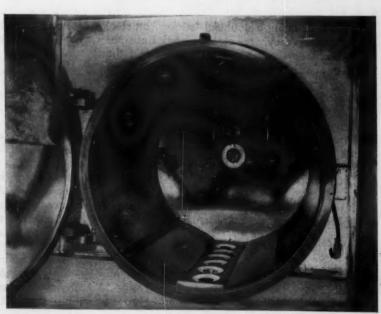
Electrical engineers are not yet in complete agreement as to exactly how ion bombardment works. As stated in the description of the coating cycle, the work is exposed to the ion bombardment, starting when the vacuum pressure reaches 60 microns of mercury, and ending at 40 microns. In this vacuum range there are obviously plenty of gaseous molecules left in the chamber. The electrical field ionizes with a positive charge these residual molecules in the partial vacuum. The work, being negative, becomes the target by attracting the ions at high velocity. The result is a bombardment of the work surface that is thought to dislodge monomolecular films of adsorbed gases from the negatively charged work surfaces. The success of the method is ample evidence that the cleaning is beneficial regardless of how the theory is explained.

The interior of the vacuum chamber, viewed through a porthole during the bombardment, is spectacular. The work appears to be filmed with shimmering lavender fire, and the spaces between the electrodes and the work fluoresce with pink light. The meters on the generator record a substantial voltage drop. As the vacuum increases, the voltage drop increases and current decreases.

The vacuum chamber is served by an F. J. Stokes Corporation dual pumping system. It has two 16-inch oil-diffusion pumps backed by one 6-inch booster pump and, further, there are two 235-cfm mechanical vacuum pumps. The system has refrigerated high-vacuum valves and baffles that eliminate "back-streaming" and maintain an oil-free vacuum.

In general terms, cadmium has always had a





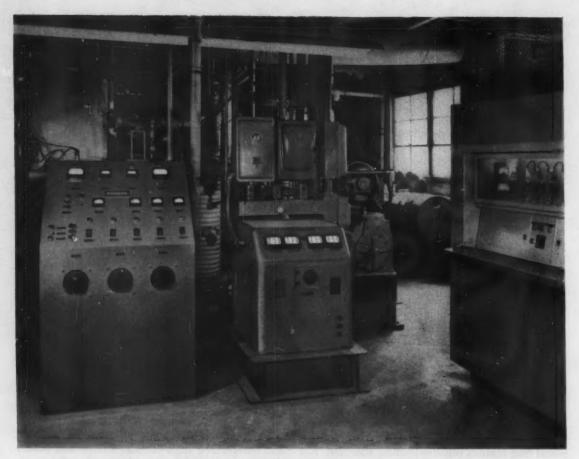


Fig. 6. Control consoles for vacuum processes are grouped in a room with normal atmosphere. At the right is the 20-kva Westinghouse direct-current supply for the ion-bombardment cleaning phase. In the center is the Tocco generator supplying heating current to vaporize the cadmium. Vacuum system control console is at left.

reputation of being a doubtful "sticker" on steel surfaces unless they were electroplated. But since glow-discharge cleaning has gone to work, the problem of adhesion appears to have been one of properly removing an invisible barrier that had prevented the direct base metal-to-coating contact for the desired adhesion.

The coatings now being produced by Catalyst Research meet the specifications for highly stressed aircraft parts (240,000 psi and over). The tests that must be met by the coated parts are listed below.

Hydrogen and chlorine embrittlement: Must be completely absent.

Adhesion: Must not flake, peel, or blister when clamped in a vise and bent through 180 degrees of arc and back.

Salt Spray: 192 hours (per Federal Test Method Standard 151A, Method 811). Porosity: Opacity must equal that of electroplated cadmium.

Coverage: Must exceed that of electroplated cadmium in blind holes.

Vacuum-deposited cadmium coatings, like plated cadmium, are satisfactory at temperatures up to 500 degrees F. At higher temperatures cadmium fails to protect steel, much the same as aluminum and other coating metals near their melting point.

A "massive" coating of cadmium deposited by vacuum is described as any thickness that can be measured mechanically by micrometer calipers.

A vacuum-cadmium surface is a dull gray matte over the sand-blasted surface. It is nothing much to look at, but the parts are free from both the threat of corrosion and embrittlement. With this factor of reliability so greatly improved the probability of structural failure is correspondingly diminished.

M_MT = pE

One job that took
fifty hours by conventional
methods now performed
in fifteen hours

CHARLES O. HERB, Editor



NUMERICAL CONTROL PROFITABLE IN JOB-SHOP OPERATIONS

ONE IMPORTANT OBJECTIVE of automation in the metalworking industries is to remove unnecessary steps and human decisions which occur between engineering and final machining of the product. In other words, to keep control of important manufacturing operations in the hands of technical experts.

Large companies were quick to realize the economic benefits of automation, and millions of dollars worth of automated equipment has been installed for turning out work of a repetitive character. The advent of numerical control, however, brought automation within the scope of smaller companies, where the work is not necessarily repetitive. On numerically controlled machines it is profitable to turn out only one piece of a complicated design at a given time.

Mechanical Specialties Co., Los Angeles, Calif., has a medium-sized plant that operates on a job-lot basis. It produces a variety of work under contracts from a number of concerns. An important recent acquisition of Mechanical Specialties is the Fosdick numerical tape-controlled jig-boring machine in the heading illustration.



Fig. 1. Aluminum casting for the IBM RAMAC computer being machined on a tape-controlled jig borer in fifty-five minutes as against three and one-half hours formerly required.

On job-shop work this equipment has established time-saving records. For example, one job formerly required fifty hours of machine time on equipment that was hand-operated. The same job is now performed in fifteen hours on a tape-controlled machine.

A typical setup involving the use of a punched tape appears in both the heading illustration and in Fig. 1. The work is an aluminum bottom casting for the memory disc assembly of the IBM RAMAC computer. The operation consists of boring and chamfering the 27/8-inch diameter hole in the center; facing the boss surrounding this hole; drilling, reaming, and spot-facing four 17/32-inch holes on the corners of the casting; and drilling and boring six 0.2495-inch diameter holes around the narrow peripheral shoulder of the circular section.

work for each successive step of the operation. After each setting, the machine spindle is fed downward by hand and returned similarly to the button to actuate the tape for the next position.

Close tolerances are specified. For example, the 0.2495-inch holes must be held to size within plus 0.0005 inch minus 0.0000 inch. Their location must be true within plus or minus 0.0003 inch. Other locations are held to within plus or minus 0.001 inch.

This job is performed in fifty-five minutes under tape control. By previous methods (also on a jig-boring machine) the operation time was three and one-half hours.

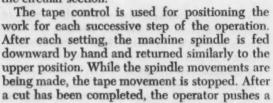


Fig. 2. Missile control-valve forging drilled, reamed, tapped, and bored in 60 per cent of the time previously required.

On the left-hand end of the machine in the heading illustration are seen the various tools required for this job in addition to the boring head in the machine spindle.

Tapes are made from either plastic or paper. Data for positioning is prepared in the engineering department and tapes are made on a Friden Flexowriter by a stenographer. Plastic is used when the tapes are to be employed time and time again for thousands of parts. Paper tapes are satisfactory for several hundred operations before they have to be discarded.

The missile control-valve forging in Fig. 2 is also drilled, reamed, tapped, and bored on the Fosdick numerically controlled jig borer. Altogether, fifty holes ranging in size from 1/8 to 3/4 inch in diameter are drilled and tapped, and sixteen holes from 1/8 to 1/2 inch in diameter are drilled and bored or reamed. All hole locations are held to specifications within 0.002 inch. This part is machined on the tape-controlled jig borer in 60 per cent of the time formerly required. The forging is made of aluminum.

Two different missile components of somewhat similar characteristics are shown in Fig. 3.

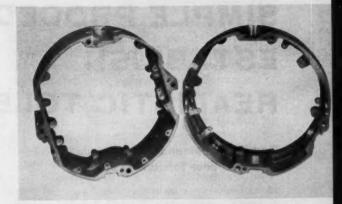


Fig. 3. Two magnesium missile castings handled on the tape-controlled jig borer in 60 per cent of the time formerly required.

A considerable number of holes are drilled, bored, and tapped around the castings to accurate locations. Areas surrounding some of the holes are faced. These parts are machined in 60 per cent of the time previously required. The castings are made of magnesium.

Electronic Brain Attacks Paper Work Bottleneck

Important reductions in industry's traditional paper work bottleneck have been made by harnessing a high-capacity computer to the task of controlling many thousands of daily manufacturing transactions. At the Norair Division of Northrop Corporation, Hawthorne, Calif., a new Automated Operations Control System uses the speed-of-light signals of its scientific computing center to eliminate, annually, two boxcar loads of paper work formerly prepared by hand.

Key to the system's operation is the successful marriage of Friden Collectadata automated data collecting and transmitting equipment to the high-speed data processing, computing, and reporting capabilities of Norair's IBM 704-equipped Computing and Datamation Center. Electronic brainpower of the computer is devoted to solving scientific and mathematical problems during the day, and to turning out manufacturing reports during the night.

AOC is being applied directly in the fabrication shops. Here, some 35,000 parts are in various stages of fabrication, and some 30,000 production orders are flowing daily to control their

With the automatic control system, the job gets done with only one production order. This order is edge-punched with a serial number by a special Friden typewriter. As the order moves through the production stream—tool stores, material cutting, and such—transmitting machines located in the shop are fed this information by edge-punching the order. As many as fifteen variables can be fed to the transmitters, allowing each and every movement of the order to be recorded and classified.

Each transmitter automatically reports its station, the serial number of the production order, and the man number of the employe assigned to the order. Sign-in and sign-out of the worker are also transcribed. Through the use of keys, the transmitter can also indicate the labor condition and, via dials, can report such information as spoilage and idle time, or the holding of an order for material, tools, and equipment repair.

This information is electronically relayed to a central receiving unit which automatically transfers the data to paper tape. The paper tape is transferred to the Computing and Datamation Center which converts the information to punched cards, and then onto magnetic tape. An IBM 704 computer receives the magnetic tape, processes the data at high speed, and relays the results back onto magnetic tape. This tape is then fed to a high-speed printer which produces the desired report at a lightning pace.

SIMPLE PROCEDURES ESTABLISH REALISTIC TOLERANCES

Part III: Combination of Accumulative and Clearance Tolerances

NORBERT L. ENRICK

IN THE TWO PRECEDING installments, we first discussed simple accumulative assemblies, and then considered fits and clearances. In this concluding article we are ready to examine a typical case history involving both accumulative and clearance problems in the assembly.

In Lines a to d of Example 3, there is shown the determination of the expected accumulation of tolerances for a bearing and snap-ring, and the resultant extremes of minimum and maximum clearance within a groove. The statistical calculations, in Steps e to h, show that the actual clearances may be expected to range from 3.6 to 11.4, as compared to the conventional range of 1 to 14.

Now, it was found that it would be extremely costly to maintain a tolerance of ± 1.5 on the groove dimension. From the statistical analysis, it was therefore proposed to shift the average groove dimension from 854.5 to 853 and open up the tolerance to ± 3 . As shown in Lines i to l, the effect of this change is to maintain a practical

range of clearances of 1.3 to 10.7, which represents a generally superior fit at a wider and therefore less costly groove-dimension tolerance.

Answering the Old-Timer's Objections

Here again, the old-timer's objections had to be answered. For, obviously, if the extremes meet, there will be interference of metal. For this purpose, the old-timer agreed that one might assume that the individual parts could be classified into groups, based on the individual tolerance values, as follows:

Average	Plus	Bearing	Snap-Ring	Groove	
3		724		850	
2		725	118	851	
1		726	119	852	
0	0	727	120	853	
	1	728	121	854	
	2	729	122	855	
	3	730		856	

Example 3. Clearance Tolerance Resulting from Assembly of Bearing, Snap-Ring, and Groove

		Bearing	Snep-Ring (The	Bearing +Ring cusandths of an	Groove Width Inch)	Clearance
	Basic size	730	120		853	A Property
b. '	Tolerance +	0	2		3	
		6	2		0	
e	Maximum	730	122	852	856	
	Minimum	724	118	842	853	
d.	Mating of extremes			852	853	1
				842	856	14
3.	Average with product centered between limits	727	120	847	854.5	7.5
	Tolerance from average #	3	2		1.5	
Z.	Clearance tolerance = $\sqrt{3^2 + 2^3 + 1.5^2}$					≠3.9
h.	Expected clearance = 7.5 ± 3.9					3.6 to 11.4
	New average for groove	727	120	847	853	16
1.	Widened groove tolerance ±	3	2		3	
k.	New clearance tolerance = $\sqrt{3^2 + 2^2 + 3^2}$					=4.1
1.	Expected clearance = 6 = 4.7					1.8 to 10.7

Since there are seven bearing dimensions, seven groove dimensions, and five ring dimensions, the total of possible combinations in assembly is $7 \times 7 \times 5$, or 245. Yet, only four of these combinations would yield interference. These are:

Bearing	Snap-Ring	Bearing + Ring	Groove	
729	122	851	850	
730	121	851	850	
730	122	852	850	
730	122	852	851	

These four represent just slightly more than 1 1/2 per cent of the 245 combinations; and would occur very rarely in practice, since the number of extreme dimensions in each product distribution is only a small fraction of the total product.

The nomograph in Figure 2 of Part II, which takes into account the fact that the proportion of extremes in each normal distribution is very small, and that each distribution has really a much finer breakdown of dimensional groups than in the simplified tabulation above, shows that for the example at hand no interferences may be expected, from a practical viewpoint.

Special Tolerancing Problems

Despite the wide use and applicability of the general statistical tolerancing formula, there are some exceptions. These occur primarily when distribution patterns of parts are nonsymmetrical, or "skewed." When skewness occurs, the distribution does not exhibit symmetry, and a "tailing out" toward either extreme side occurs. The general formula for statistical tolerancing will then be inapplicable, and statistical analysis in general will become quite complex. We then have only one of two choices:

- Allow for tolerances of assemblies by means of simple (nonstatistical) additive procedures.
- Seek to predict the probable distribution pattern of the assembly by means of trial "dry-run" assemblies on electronic computers.

Where access to a computer can be had, the second method will generally be found to be relatively inexpensive in relation to the benefits obtainable from tolerances that are as realistic as feasible.

The problems presented by skewed distributions are the reason why the reader has been advised to check control-chart data. In many instances, such as production involving eccentricities, radial play, screened and sorted product, or small lots, a check of control charts and the distribution patterns they reveal is especially ad-

visable. In other cases, where experience has shown that skewness need not be expected, a check of frequency patterns may be deemed superfluous. Often, of course, a check of frequency distributions will reveal skewness where none ought to be, such as in certain dimensions of ball bearings, thus indicating where production needs to be corrected.

The task of reaching optimality in tolerancing is thus part of an effective over-all quality-control program for the plant. Ultimate costs are greatly affected by the care which has gone into establishment of proper specifications and tolerances for the components of mass production. As pointed out by Earle Buckingham: "There is probably no other place in the organization where so much money can be wasted by carelessness and ignorance."

* Dimensions and Tolerances for Mass Production, THE INDUSTRIAL PARSS, New York 13, N. Y., page 17.

Combined Production Rate for Several Operations at Different Rates

F. MURRAY

When the combined or average production rate for several operations on a part is required, the use of either a table of reciprocals or a sliderule simplifies the calculations involved.

The formula used in the calculations is:

$$R = \frac{1}{1/a + 1/b + 1/c + \dots 1/n}$$

In this formula, R is the combined or average production rate in parts per hour and a, b, c, d, etc., are the production rates in parts per hour for individual operations such as boring, milling, etc.

As an example, to find the production rate for a part that has four operations performed on it at the rates of 75, 115, 175, and 225 parts per hour, we would have

$$R = \frac{1}{1/75 + 1/115 + 1/175 + 1/225}$$

$$= \frac{1}{.0133 + .0087 + .0057 + .0044} = \frac{1}{.0321} = 31.1$$

The values .0133, .0087, etc., as well as the final result 31.1, were obtained directly from a table of reciprocals such as that in Machinery's Handbook. Value 31.1 was obtained by interpolation.

If a slide-rule is used the answer can be quickly found by the use of the CI and D scales. It is necessary only to move the runner to each rate on the D scale and read the reciprocal on the CI scale. The reciprocals are added arithmetically and the runner set to this sum on the CI scale. The answer 31.1 is read on the D scale.



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CABINETMAKING FOR THE MISSILE AGE

WHEN THE U. S. Army Ordnance Corps decided that even such bulky items as radars on wheels must be designed and manufactured to be easily transported by air, a revolution was started in associated metal furniture production that has had far-reaching effects on the development of cabinets in Western Electric's Burlington, N. C., plant. Mobile wartime radars were bulky, heavy, and entirely ground-bound. Postwar thinking envisaged the problem of logistics from an entirely new concept in which mobility and transportability were, if not primary considerations, at least secondary only to speed of operation, ease of maintenance, and versatility.

Today, with major areas of population in the United States—as well as certain strategic areas in the free world—being defended from aerial attack by Nike guided-missile sites, the need for lightweight equipment is of even greater moment. Much of the ground guidance equipment for the Hercules, latest version of the Nike sys-

tem, is housed in metal cabinets that are installed in trailers.

Cabinet production is by no means an automated process. It is, rather, a job-shop type of operation dealing in quantities ranging from two to ten a month of thirty-five different sizes and types. Also, design changes are frequent and must be quickly assimilated.

One requirement of these cabinets is that the electronic units they contain be interchangeable and readily accessible for servicing. In the event of trouble, the offending unit must be quickly removed and a spare unit plugged into position. To achieve this goal, tolerances within the large welded structures (ranging in size up to 6 by 6 feet) are held to plus or minus 1/32 inch, and over-all tolerances are held to 1/8 inch on the plus side only.

During the past few years a considerable amount of magnesium alloy has been utilized in this field. It finds extensive application in the fabrication of panels, chassis, and cabinets—an example of which is the Nike-Hercules tracking console shown during final stages of assembly in

the heading illustration.

Initially, parts were produced from sheets of magnesium. When the bend radius approached two or three times the sheet thickness, forming was done in heated dies at a temperature of 600 degrees F. Even when worked in a hot condition, some shipments of material could not be successfully formed and cracking was a constant plague. This led to extensive redesigning of the components around various forms of extrusions to replace formed sheet-metal sections, and was probably the most important factor in determining the future trend in cabinet manufacture. Shown in Fig. 1 are but a few of the more than 350 different extruded shapes being used in both magnesium and aluminum.

Evolution of cabinet-door design exemplifies the substitution of extrusions for formed sheetmetal parts. The doors were originally made of a formed aluminum or magnesium sheet stiffened by formed sections and perforated interlinings and completed by a strip to hold the gasket in

A major improvement consisted of substituting an extruded frame section containing a gutter for the gasket tang. Even the hinges were extrusions milled to form interlocking leaves. The ultimate step in this development is the use of two extrusions to form the complete side frames. A flat sheet-metal cover is joined to them, forming both door skin and frame. The door can be completed

by adding a top and bottom finishing strip and providing for handle mounting. These three stages of development are illustrated in Views A, B, and C, respectively, Fig. 2.

Two methods of joining sections of the door panels are used, depending on construction details. Continuous shielded-arc welding is applied to the door shown in View C, Fig. 2. Here, a 1/8-inch thick sheet of magnesium is joined to two magnesium side extrusions. This is done on a company-built machine, Fig. 3, using a Linde Oxweld head. It is capable of handling joints up

to 6 feet in length.

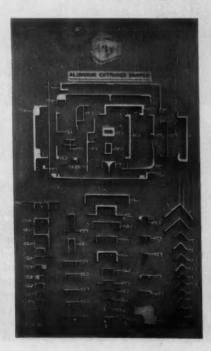
The side extrusions are first laid on the worktable and locked in place by rows of individual air clamps. A magnesium sheet is then set in position on the extrusions and secured by long clamping bars. One seam is laid down at a time by the single welding head. When the first has been completed, a carriage supporting the head and its track advances to a position above the second joint.

Spot welding is the second method of assembling door panels. A cross section of a typical door designed for this type of joining is shown in View B, Fig. 2. On a door the size of the one shown in Fig. 4, approximately forty-two spots are used, their spacing being determined by the operator. Welding is done on a 200-kva Sciaky machine using a 5/8-inch diameter upper electrode and a 7/8-inch diameter lower electrode.

Shielded tungsten-arc welding, using argon gas, is employed in the fabrication of the magnesium and aluminum structures. In Fig. 5 a

Fig. 1. Extensive use is made of both aluminum and magnesium extrusions in the production of large cabinets. Here is a sampling of the more than 350 different shapes used.





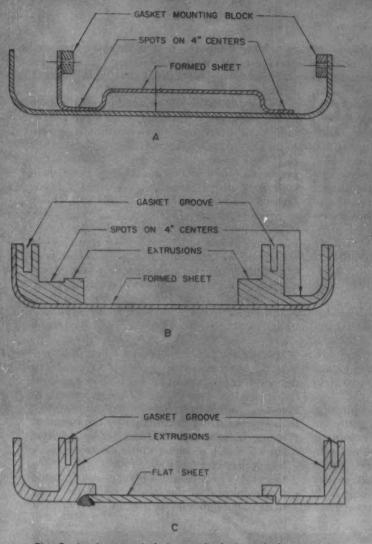


Fig. 2. As door-panel design evolved, formed sheet-metal parts (View A) were replaced to a great extent by extruded sections covered by a formed sheet-metal skin (View B). An ultimate design (View C) uses two extrusions with a panel joined between them to form both door skin and frame.

swinging gate for a Nike-Hercules computer-amplifier cabinet is being welded with Miller equipment. Groups of receptacles for electrical plug-in units are being joined to a frame, and are held in accurate alignment by rugged fixturing. The receptacles are made of AZ31B magnesium, while the filler rods are of J-1 magnesium.

Until recently, argon was supplied from a sphere close to the shop. This sphere, which is, in effect, an insulated tank, contained liquid argon at low pressure and at a temperature of minus 400 degrees F. The liquid capacity was the equivalent of 100,000 cubic feet of gas, which was piped to a manifold feeding the various welding booths. As a cost-saving step, a change has

been made from liquid argon to compressed argon gas. Since compressed argon gas is stored under considerable pressure, it is contained in oversize gas cylinders that are stacked and permanently attached to a semitrailer.

One property of magnesium that was influential in its selection for cabinet frames is the ease with which large structures can be squared up by stress-relieving. After being welded, the frames are rigidly clamped against straight steel support members and rolled into large annealing ovens. They are held at a temperature of 350 degrees F. for approximately three hours, then removed and allowed to cool in air. Internal stresses and distortion due to welding will have been removed, and the weldments will assume the straight shape of the steel backup plates. This procedure is also used on door panels.

Most of the holes in the cabinet frames must be located within a total tolerance of 0.005 inch. To accomplish this, all critical drilling is done after welding and annealing. This, of necessity, calls for the use of drill jigs that approach the proportions of the cabinets themselves. Here, again, aluminum and magnesium are utilized to make the fixtures lighter and easier to handle.

Application of one of these drill jigs is shown in Fig. 6. As

can be seen, the tool is as large as the cabinet front. It locates from the bottom of the structure so that all holes will be in proper relation to one another. Drilling is done by hand with a Keller portable pneumatic tool.

Fire is an ever-present hazard in the fabrication of magnesium products. An interesting aside might be some of the precautions being taken in the Burlington cabinet shops to minimize such a possibility. Efforts are made in the machining area to keep chips as large as possible, thereby reducing the fire hazard. Grinding is done only in the open, or on belts exhausted into waterbacked dust collectors. Floors are swept every half hour to prevent accumulation of small mag-

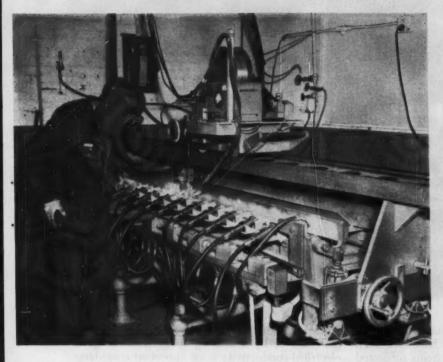


Fig. 3. (Left) Special machine for the shielded-arc seam welding of door panels. A single welding head lays down one bead, after which it advances to the next joint where a second weld bead is deposited.

Fig. 4. (Below) Setup for spot welding formed door panels to extruded members. On a door of this size, approximately forty-two spots are made by the 200-kva machine.

nesium particles. Building structures, including tops of storage cabinets, are vacuum cleaned on a continuing basis since some of the particles are so light that they are carried upward by air drafts. Fire extinguishers of the carbon powder and Ansul foam types are distributed throughout the shops.

Magnesium-Alloy Cabinets—Design Considerations, Surface Preparation, and Finishing

Because magnesium is the most anodic of the structural metals, it is important that careful selection of protective finishes be made. Also, to prevent the formation of galvanic couples, sound engineering principles must be applied in the selection of other metals to be joined with the magnesium alloy. Galvanic corrosion will occur in humid environments if dissimilar metals, too farremoved in the electromotive series, are allowed to come in contact with alloys of magnesium. Potential corrosion at faying surfaces between the alloy and a dissimilar metal can be minimized, or even eliminated, by the proper choice of finishing systems.

For physical characteristics unattainable with magnesium alloys, it is necessary that some cabinet components be made of other metals. These metals are selected with care. For example, rivets





are made of 5052 or 6053 aluminum alloys and are finished by anodizing. Small hardware such as screws, clinch nuts, and other items subjected to little or no abrasion are made of steel. They are protected by zinc or cadmium plating which, in turn, is passivated by chromating. Items such as door catches, cams, shafts, and other parts subjected to considerable wear and abrasion are made of stainless steel and are chemically passivated prior to assembly.

When parts must be soft-soldered, the metal selected is normally brass which is subsequently copper-tin plated. Items of this nature are generally separated from the magnesium by other materials or by insulating compounds. If good electrical conductivity is an important consideration, parts are usually made of brass, nickel, silver, copper, beryllium copper, phosphor bronze, etc. They are normally plated with gold, silver, silver rhodium and, in some cases, nickel. These parts are not placed in direct contact with the magnesium alloys.

Except for the anodizing of magnesium alloys, the Burlington cabinet shops have facilities for producing all necessary plated and organic finishes. Chemical surface-treatment tanks of a size

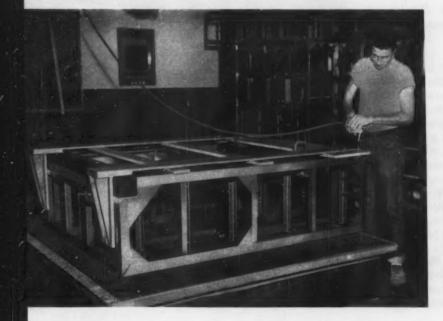


Fig. 5. (Above) Plug-in receptacles are being welded to the magnesium frame of this swinging gate for use on a Nike-Hercules computer - amplifier cabinet. Shielded tungsten-arc techniques are employed.

Fig. 6. (Left) For accuracy of location, most holes in cabinet frames are drilled after welding and annealing. To do this, large magnesium and aluminum jigs are used. The jig here is locating all holes from the bottom of the structure.



Fig. 7. Facilities for all of the required plating and organic finishing are available, with the exception of magnesium anodizing. In a preliminary step, this frame is lowered into a large vapor-degreasing tank.

capable of accommodating a welded cabinet frame are available. One of these, a Blakeslee vapor-degreasing tank, is shown in Fig. 7. This particular tank is equipped with covers that are closed by air-hydraulic controls when the welded structure is placed within it. Since the covers have been installed, approximately one-half the trichlorethylene previously used is now being saved.

Although finishes selected for use directly on magnesium alloys are fairly standardized, some flexibility of choice is exercised depending on the environment in which the units are to be used. In a typical finishing system for those alloys to be used in an area that is protected from exterior exposure, the initial chemical film is a dichromate treatment (Dow No. 7 finish). This is followed by two coats of zinc yellow primer. Top coats are of alkyd enamel of the selected color.

When magnesium alloys are to be exposed to exterior climatic conditions, more protection is usually required than that just outlined. In a representative finishing system to meet these operational conditions the magnesium is first anodized. After this, a coating pretreatment (wash primer) is followed by two to four coats of vinyl zincchromate primer. For the final finish, two coats of alkyd enamel of the desired color are then applied.

A bank of large ovens is used during the finishing procedure. After each coat, with the exception of the wash primer, the cabinets are baked for a period of twenty minutes at a temperature of 325 degrees F. In Fig. 8 can be seen a computer cabinet being removed from one of the ovens.

Fig. 8. Computer cabinet is removed from one of a bank of large ovens. The cabinets are baked for twenty minutes at 325 degrees F. after each finishing coat, except for the wash primer.



STEPLESS SPEED VARIATION WITH EPICYCLIC GEARING

W. A. Tuplin, D.Sc., M.I.Mech.E.

One of main problems in the design of steplessly variable power transmissions involves getting an adequate range of useful speed variation without too much of a sacrifice in efficiency. In this article the author describes and analyzes a few types of variable-speed epicyclic gear transmissions and indicates some of their limitations

SINCE, IN GENERAL, a prime mover develops its maximum power at high efficiency only over a rather limited range of speed, there is a need for transmissions with conveniently adjustable velocity ratios. The field of application of variable-speed gear transmissions has two main subdivisions based on the torque characteristics of the driven machine. In the first group, the torque is substantially independent of speed or, if not, tends to fall with speed; in the second group, the power transmitted is substantially constant, and the torque therefore rises as speed falls.

In the first group, the speed is varied because the functions of the driven machine demand it; in the second group, the speed is varied so that all the available power (or a large fraction of it) may be delivered to the driven machine over a wide range of resisting torque developed in it. In both groups, the usual ideal is to have as many different velocity ratios as can be provided at reasonable cost.

Steplessly variable speed reduction has been the subject of many inventions and the flow of them is unlikely ever to cease. In some cases, the desired end can be achieved by the combination of a pump and a hydraulic motor, or of an electrical generator and an electric motor. Either of these schemes is capable of giving a reasonably high efficiency at low velocity ratios, but tends to waste bigger fractions of the input power as the velocity ratio rises. With regard to cost, a variable-speed electric motor is much more expensive than a standard constant-speed motor having the same maximum output torque, and a gear-box that offers any one of a large number of velocity ratios by means of as many pairs of gears would also be expensive. It would seem impossible to devise a purely mechanical device to give stepless changes of velocity ratio over any wide range of speeds at a price that makes it economically feasible.

Reciprocation over a steplessly variable range of stroke is easily attained by means of a slotted lever of steplessly variable velocity ratio, reciprocated at constant frequency. A combination of a number of such reciprocatory motions by ratchets may be used to produce unidirectional motion with nonuniform velocity; a combination of roller ratchets operated by an equal number of slotted levers having appropriately phased reciprocation can give a close approximation to uniform rotation of an output shaft. This scheme has been tried repeatedly but the life of the ratchets is short unless the transmitted torque is small in relation to the dimensions of the mechanism and, particularly, of the ratchets. In other words the scheme is not economical.

Epicyclic gears offer superficially attractive

means of obtaining wide variations of speed, but close examination shows that the apparent advantage is sometimes illusory. For example, in Fig. 1 the output shaft D rotates at a speed relative to the carrier E and equal and opposite to that of A relative to E. Neglecting friction, the torque on D is equal and opposite to that on A and the torque on E is equal to twice that on A. This is the torque that must be applied to E to prevent it from rotating. If the restraining torque is applied by a brake, the load on the brake may (in principle) be adjusted so that E rotates at any selected speed up to half that of A and the speed of D may consequently be any selected speed between that of A and zero.

Although a device of this sort can give steplessly variable speed, it does not meet all of the implied requirements of a variable-speed transmission, among which is that of dissipating not more than a small fraction of the input power. If the fraction could be zero, the output torque would, of course, be the product of the input torque and the velocity ratio. In other words, what is needed must be not only a speed reducer, but also a torque increaser, if it is not to be wasteful of power at high velocity ratios.

The device shown in Fig. 1 maintains near equality of the magnitudes of the torques on A and D, and so the power dissipated by the brake is equal to the product of the input power and $[1-(\text{output speed} \div \text{input speed})]$. Apart from its reversal of the direction of rotation, the assembly works in the same way as a slip clutch. Whenever the velocity ratio is less than unity, friction dissipates power and causes wear of the brake lining.

Instead of using a brake to restrain the carrier

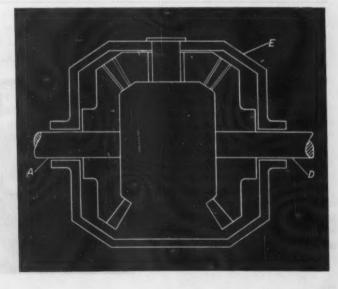
E, it might be connected to the input shaft of a pump discharging oil through a valve adjustable to give the desired speed to D. Neither this nor any other means of permitting E to rotate affects the equality of torques on A and D; thus the basic defect of the scheme is not avoided. The adjustability of the brake or the pump discharge valve does not alter the fact that the external torque applied to E is always equal to twice that on A; therefore this cannot be a torque-multiplying device.

There are well-known speed-change gear units containing several trains of epicyclic gears and offering any one of a number of different velocity ratios by appropriate locking of certain carrier members by brakes. Intermediate velocity ratios are obtainable by easing off brake pressure till slippage cocurs, but this dissipates power just as in the scheme of Fig. 1, and such a way of working is tolerable only for occasional short periods.

An inversion of this scheme is to provide an auxiliary motor of variable speed to rotate the carrier instead of allowing it to slip. The power taken by the auxiliary motor is passed into the drive (frictional losses excepted) and is therefore not lost, as is power dissipated by brakes. One might be tempted to imagine that this auxiliary motor could be small compared with the main motor, and much ingenuity has been expended on developing schemes for epicyclic gear arrangements to work on this principle. Without going into any details, however, it may be shown that the scheme has a limitation that tends to make it uneconomical.

Fig. 2 represents the external essentials of an epicyclic gear assembly. The input shaft is A and

Fig. 1. Epicyclic gear transmission in which output speed of (D) depends on speeds of (A) and (E).



the output shaft is D. The shaft F is an auxiliary

input shaft.

Neglecting internal friction, the power output at D is equal to the sum of the power input at A and F. Any change in speed of F is accompanied by a change in speed of D, and the change in output power is equal to the change in input power. Consequently,

 $\frac{\text{change in speed of } D}{\text{change in speed of } F} = \frac{\text{torque on } F}{\text{torque on } D}$

This means (for example) that if the auxiliary motor is to be much smaller in output torque than the main motor, the speed variation of F must be much greater than that of D. If the required range of speed variation of D is small, a scheme of this kind permits the main motor to run at constant speed, while the output torque and speed range of the auxiliary motor may be given any values that have the same produce as the corresponding quantities for the output shaft,

Instead of using an auxiliary motor to drive shaft F, it may receive power from shaft A by some form of transmission with a steplessly variable velocity ratio—for example, a belt on conical pulleys or a bevel-gear driven cross-shaft carrying an axially movable friction wheel pressed against another disc mounted on F. In the second alternative, the friction wheel may be capable of being transversed beyond the axis of shaft F. Power then passes either from A to F or from F to A, according to the position of the friction wheel.

A scheme of this sort permits adjustment of the speed of the output shaft within a limited range by means of an auxiliary drive. This auxiliary drive transmits only a small fraction of the total power input and may therefore be small

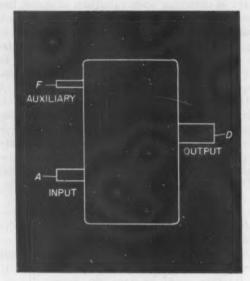
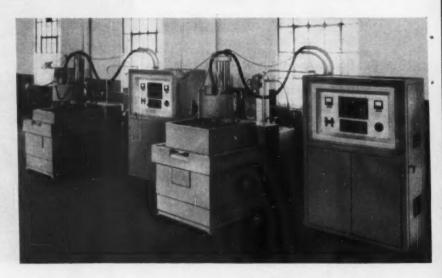


Fig. 2. External essentials of an epicyclic gear transmission assembly.

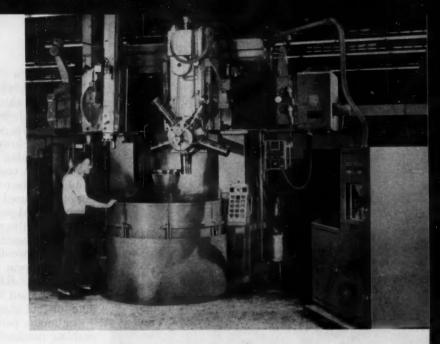
compared with the main drive. If the setting of the adjustable element is determined by a speedsensitive device driven by shaft *D*, then the effect of any slippage at the friction surfaces may be automatically cancelled.

Stepless speed variation over a range of speed from the maximum down to f times the maximum is thus possible by means of epicyclic gears in conjunction with an auxiliary drive that has a steplessly variable velocity ratio and that transmits only (1-f) times the input power. If f lies between (say) 1 and 0.7, this may bring the solution of the basic problem within the range of readily available variable-speed transmissions.

Sundstrand Machine Tool Division of Sundstrand Corporation, Rockford, Ill., has opened a methods laboratory for testing electrical discharge machining. The laboratory's primary function is to investigate the applicability of the process to different machining problems. A subcontracting service for job-lot runs is also available. The machines, of French design, will be made under license by Sundstrand.



This vertical boring mill, said to be the first one designed for numerical control, can be run either from a pendant or a swiveling station that is mounted on the floor to permit speedier setups.



J. K. McGEE

Manufacturing Engineer

Gray Tool Co.

Houston, Tex.

TAPE-RUN BORING MILL SPEEDS PARTS TO WELL DRILLERS

MMT = PE

The first numerically controlled vertical boring mill ever built is at work for an oil-field equipment maker

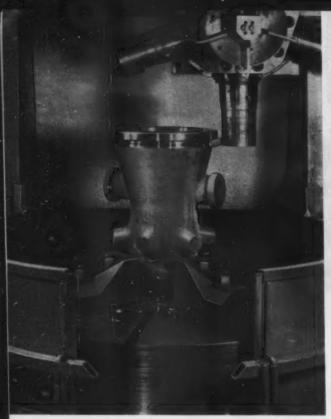
A NEW CHAPTER in numerical control is being written by a 54-inch Giddings & Lewis Numeri-path-equipped vertical boring mill at the Gray Tool Co., Houston, Tex., manufacturers of specialized production equipment for the oil-field industry. This is said to be the first numerically controlled vertical boring mill ever built, and the first application of magnetic tape, continuous-path machining outside the aircraft industry.

According to Gray's manufacturing department, there is no question of the advantages of continuous-path control over point-to-point control in his company's operations. It permits extensive use of standard throw-away carbide inserts instead of special form tools, boosts production, and provides other benefits as well. Reduction in inventory also is made possible, because parts for which tape has already been prepared now can be machined to order and shipped within a matter of hours.

The value of the machine can be appreciated when the nature of the company's business is understood. First, short runs of a wide variety of parts are a daily routine. The range is from one to thirty parts per run; the average, three. Even so-called standard items must be supplied with many small variations to meet customers' specific requirements. Another "must" in serving the oil-field industry is the need to give almost immediate delivery on equipment.

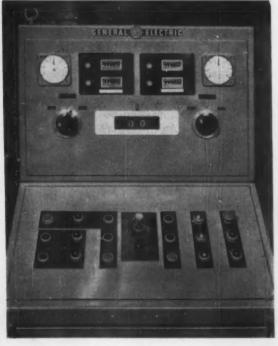
Drilling an oil well is an expensive operation. Delivery delays by an equipment supplier can cost thousands of dollars a day. Besides, it is not at all unusual to get an urgent call to duplicate a part made twenty years ago. Most of the parts are steel forgings or castings. Quality is paramount because of the high pressures encountered.

The boring mill was purchased as part of a program initiated some time ago having these objectives: aid shop personnel in meeting cost, delivery, and quality requirements; reduce inventory of processed and partly processed parts; replace single-purpose manufacturing equipment with multiple-purpose machines; make extensive use of throw-away carbide inserts; duplicate parts



Close-up view of the machining of one end of a part known as a casing head. Throw-away insert, under numerical control, single-points recess next to flange.

Read-out odometers on console show tool location with respect to coordinate reference points. If necessary to withdraw a tool temporarily, odometers can be logged to facilitate resetting.



at any time in the future economically and accurately, without the need for templates; expand production within present floor space and at minimum capital investment; and, finally, assure reasonable profits while maintaining good wages and holding down prices in the face of inflation.

The reasoning behind the selection of a machine with a continuous-path control system is of interest. The company's work involves machining of contoured surfaces, straight surfaces, and many tapered surfaces at angles other than 45 degrees. If a discrete positioning (point-to-point) system were used, a considerable amount of special tooling would be needed. The continuous-path system, on the other hand, permits maximum use of standard throw-away carbide inserts, with a resultant lowering of tool cost and down time for tool changes.

Continuous-path control also is credited with enabling the machine to be utilized at maximum horsepower when required, thereby securing maximum production without undue concern over tool life—an economical procedure in view of the low cost of the inserts and the speed with which they can be replaced. A valuable side effect of the installation of the new boring mill has been in selling customers on the capabilities of the company, its service, and quality of its products.

Basic numerical data is put on punched cards and run through an IBM computer to produce a manuscript and another set of punched cards. These cards, in turn, are sent to Giddings & Lewis in Wisconsin, where they are used to prepare the magnetic tape. In this way, Gray has been able to eliminate investing in a director and certain other tape-preparation equipment. To date, about fifty different parts have been programmed. The first to be processed on the new machine was the casing head seen in the accompanying illustrations of the boring mill.

Many different pieces of equipment the company makes have parts which are similar in shape. As a result, there are programming and machining subroutines in common among them, and it is not necessary to make up a complete new set of punched cards for every part. Existing cards can be used for those areas which are identical in contour to a part already programmed; new cards, of course, must be made for those areas which are found only on the new parts.

Another feature is the use of "position sheets" instead of a manuscript at the machine. These give the operator a picture of exactly where the tool should be at any stage of the operation, and he can check this by the electronic read-out with which the machine is equipped. The sheets also make it possible for the operator to stop the machine and back out the tool for inspection or other purposes, and then to accurately reposition it and

again machine without cut-and-try procedures.

The boring mill is equipped with a five-position, right-hand, power indexing turret head and a left-hand, swiveling ram type railhead. Operation of the machine—feed and traverse of the turret head, ram, and saddle; indexing of the turret head; and rotation of the table—can be programmed or can be controlled from a pendant. The ability to program a constant cutting speed over a wide range of diameters assures optimum production rates, long tool life, and good surface finish. Other features of the boring mill include a

mist coolant system and four-jaw power chuck.

Maintenance has presented no particular problems. The Numeripath control circuitry is described as being simpler than in a television receiver because each tube performs only one function. Shop personnel are perfectly competent to handle the electronic maintenance. Presently, Gray is setting up tube-replacement schedules. Periodic voltage checks indicate relative tube conditions and, when below an established minimum, weak tubes are replaced. Down time due to tube failure will be virtually eliminated.

OUT-OF-SQUARENESS MEASURED DIRECTLY

CLINT McLaughlin, Rockaway Beach, N. Y.

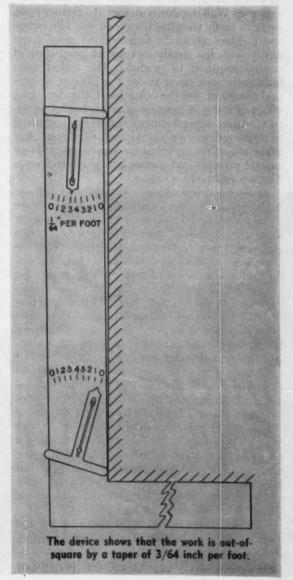
Two pointers attached to an ordinary steel square give a direct reading of the out-of-square condition of an object. The reading is shown as

the amount of taper per foot.

The pointers, which are T-shaped, are fastened along one leg of the square, as illustrated. Each pointer is mounted on a shouldered pin riveted in a hole drilled in the leg. A piece of spring wire has one end staked in a cross-hole in the pin and the other end bent 90 degrees and held in a slot in the pointer. This keeps the pointer normally centered and holds it against the work in use. It will be seen that the horizontal section of each pointer is wider than the leg, thus enabling the contact to be made. By having the shape of a tee, the pointers can be used in examining either an inside or an outside corner.

In the illustration, the square is shown against an outside corner which is less than 90 degrees. The lower pointer reads almost 0, and the upper pointer reads 3—indicating a taper of 3/64 inch per foot. If the corner were greater than 90 degrees, the upper pointer would read almost 0, and the lower pointer would read the amount of the error. In either instance, should the error be greater than 4/64 inch per foot—6/64, for example—the pointer would show an error of only 4/64, since it would not contact the work. Thus, whenever the pointer reads 4, it should be swung farther until it is brought into contact. (In this case, it would go to 2, so the error would be 4 plus 2, or 6/64.)

These particular pointers have a multiplication ratio of 5 to 1, but other ratios can be used. Because of the way the pointers swing, the ratio changes slightly, so it is better to calibrate the device by placing it against an angle-plate set up on shims to produce a known error. If desired, the calibration can be in degrees instead of taper per foot.





Talking With Sales Managers

BERNARD LESTER

Consulting Management Engineer

Smooth Out That Sales Curve

PEAKS AND VALLEYS may decorate the landscape, but should be kept out of the sales curve.

Are sales managers fully aware of the extent to which fluctuations in sales volume affect sales expense? Walking down an inactive factory aisle, one can easily visualize the expense of idle equipment. Fluctuations in factory load grow more costly with the steady increase in proportion of capital required to produce. The added costs habitually seek cover under the blanket of general overhead. On the other hand, the damaging effect of a dip in business is much harder to detect within a marketing department consisting of scattered groups of salaried employes. Any first-class sales organization represents a large capital expense and carries heavy indirect costs that are relatively constant.

Aside from variations in the state of the national economy, dips in a plant's sales curve are mainly due to: dependence on single lines or large-dollar orders, seasonal inactivity, design changes, disregard for product obsolescence, unawareness of customer needs, or periodic let-downs in sales drive. Better sales programming can largely avoid dips in the sales curve from any or all of these causes. It is not enough to prepare to fill customers' current needs. The alert sales manager must also determine customers' future needs and prepare new products to satisfy anticipated specifications.

There is a great temptation to seek relief from sharp irregularities in the sales curve by increasing the lines of products furnished. As one sales manager put it: "Diversification in our types of equipment got all our attention for a while. But later we woke up to the fact that we must do a lot more than diversify in order to stabilize our business. For instance, besides adding to our lines, we now do extensive maintenance work and rebuilding or retooling older equipment not always originally built by us."

Another sales manager complained of the glamor attached to the phenomenally big job. He said that everyone's attention is distracted by a big-dollar sale. This is too often applauded at

the expense of the fellow whose steady work pays the rent but can never involve the spectacular.

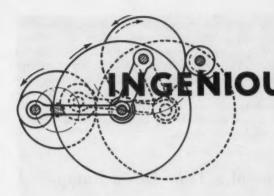
Although tradition dictates that business falls off in the summer, last January hundreds of food, clothing, and hardware companies planned campaigns to offset this usual slump. Better planning and greater sales drive can help increase the summer sales of machine tools, too.

Obsolescence in our product design often creeps up on us unnoticed. The result is a mysterious sales fall-off that has no apparently logical reason. But a study of product obsolescence shows that sales management may have overlooked the great importance of continuous product analysis and close contact with one's design engineers.

A study of territorial markets is essential to minimize sales curve dips. A fault easy to overlook is that of concentrating sales effort only according to present market potentials. Market trends must be anticipated to take advantage of the fortunes of various industries, growth and shifts in population, and the fact that the concentration of industrial activity is constantly on the move. This trend is increasingly affecting rural areas where branch manufacturing plants spring up almost overnight to alter the economic and social patterns of entire areas.

Here are time-proved rules for smoothing a bumpy sales curve:

- · Diversify product lines.
- Concentrate on getting a bigger volume of smaller orders.
- Introduce off-season sales drives.
- · Look ahead toward customer needs.
- Watch for early signs of product obsolescence.
- Meet the anticipated sales drop with preplanned sales tools.
- Anticipate long-term market trends with research.
- Stress service as one of the best sources of repeat orders.
- Be sure that every salesman knows he has the full backing of the home office.



OUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Transmission Remotely Controlled by Triple-Action Cylinder

EDWARD F. DEZABALA, Corning, N. Y.

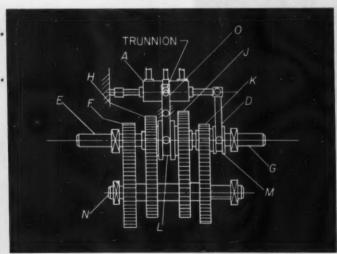
A triple-acting cylinder arranged to remotely actuate a special purpose transmission is illustrated in Fig. 1. Designed for low cost and made of standard components, the device can be pneumatically or hydraulically operated.

Cylinder A contains two piston assemblies B and C (Fig. 2). Assembly B is pivoted on a fixed pin at the rod end, while assembly C is linked to level D but is free to move to the right. Trunnions are mounted on the cylinder shell, and flexible lines are employed to supply and exhaust the pressure chambers.

Input shaft E is integral with a gear F. This gear has a recess in the right-hand face that serves as the front bearing for an output shaft G.

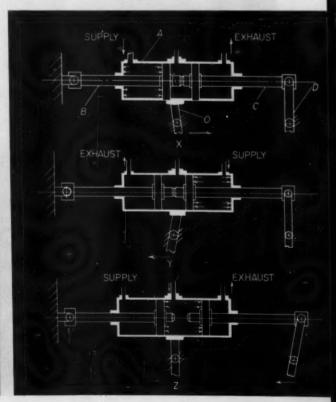
Fig. 1. (Below) Triple-acting cylinder (A) permits remote control of this gear transmission. Either pneumatic or hydraulic operation is possible.

Fig. 2. (Right) Lever movements that result when a fluid is introduced under pressure into each section of the cylinder. A different section is vented in each case.



Gears H, J, and K idle on shaft G but are restrained from axial movement. Dual face clutch L and a rear clutch M are splined to this shaft but are free to float axially. The gears on shaft N are secured to it and are in positive drive with those on shafts E and G.

When the left-hand chamber (View X, Fig. 2) is pressurized, the cylinder body moves to the left, and the trunnions tilt a pivoting forked lever O. This lever, in turn, slides the dual face clutch L to the right, thus engaging gear J to output



shaft G for drive. If the right-hand chamber is pressurized (View Y, Fig. 2) the cylinder body moves in the reverse direction and the left-hand face of clutch L engages gear H to the output shaft. Pressurizing the center chamber (View Z, Fig. 2) will force the rear piston-rod to the right, pivoting forked lever D so that it engages the rear clutch M with gear K.

Cone type clutches with meshing teeth pro-

vide a positive engagement with the gears, thus allowing a low pressure to actuate the system. Coil springs are mounted on shaft G between the clutches and gears H, J, and K. These springs overcome any piston-seal friction and disengage the clutches when the pressure actuating the cylinder is released. The triple-acting cylinder in itself has versatility for other industrial remotecontrol applications.

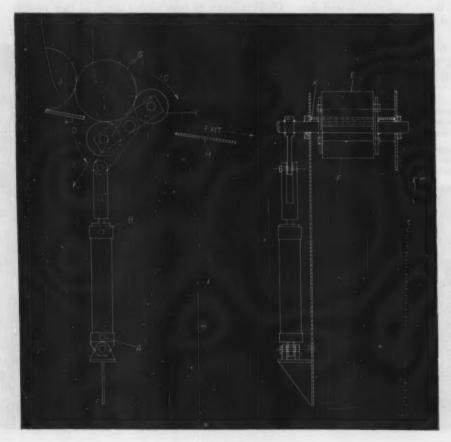
Escapement Feeds Cylinders One at a Time Down Ramp

RICHARD MARSH, Lima, Ohio

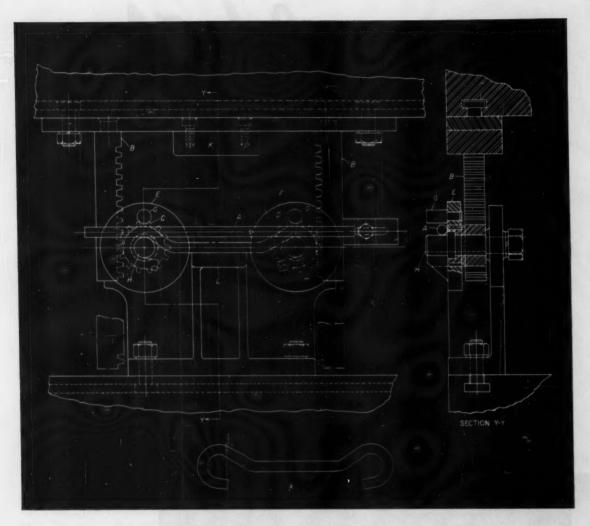
In mass-production plants, cylindrical parts are frequently rolled downhill in chutes from one machine location to the next. An example is the gravity handling of automotive pistons in partly finished condition. Because the force is gravity, the backup of parts in a chute is a convenient feed magazine. How to release automatically one work-piece at a time to feed a machine tool is often a problem.

The illustration shows a home-built, air-powered escapement device for installation in a gravity feed chute for handling cylindrical parts. Its operation can easily be interlocked in the electrical system of a machine tool. Compressed air entering cylinder port A swings the cage of rollers E and F in direction C. Rollers E and F are freewheeling. As the roller cage swings, the work cylinder G will roll off to ramp H. At the same time roller F rises to hold cylinder J on ramp K.

For the return stroke, compressed air enters port *B*, exhausting air from port *A* and swinging the roller cage back to its original position with cylinder *I* set to be ejected down the line.



Cylindrical work parts (G) from chute (K) are fed ene at a time down ramp (H) by the rocking of roller cage (E-F). The air cylinder has a clevis fastening below part (A) permitting it to swivel. Flexible air hoses lead to ports (A) and (B).



ingenious tooling designed for forming eyelet rods, such as seen at X, from flat stock.

Bending Device for Double-Eyelet Rod

RALPH T. STEWART, Winston-Salem, N. C.

Tooling designed for simultaneously bending an eyelet at each end of a short metal rod is here illustrated. The work-piece is seen at X. Incidentally, the eyelets are closed somewhat more than shown by using a hand tool when the rod is installed on agricultural equipment.

The tooling was designed for use on a hydraulic press, this type of equipment being especially desirable because racks for actuating the mechanism could be conveniently mounted on the plunger of the press. Another advantage derived from this type of equipment is that the press stroke is adjustable and can be set to the exact amount required for the racks to operate pinions that actuate the tooling.

In an operation, the straight bar is laid on the tooling as shown at A. When the press plunger

descends, it lowers racks B which are attached to the press ram. These racks revolve pinions C and D, causing pinion C to turn in the counterclockwise direction, and pinion D to rotate clockwise.

The revolving pinions cause plates E and F to turn and to carry pins G downward around the respective circles. These pins bend the ends of the rod around studs H to form the eyelets. Block K bends down the center of the rod until it rests on top of anvil L, as indicated by dotand-dash lines.

Minor changes in the tooling could be made for closing the eyelets more completely. In such a case, it would be necessary to increase the stroke of the press. This inexpensive tooling has saved a great deal of time and hand work in making eyelet rods.

TOOL ENGINEERING

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Spherical Surfaces Milled with Fly Cutters

ABRAM LEW, Haifa, Israel

In the manufacture of parts having the composite form of a cylinder, a partially relieved cone, and a sphere, economical machining of the spherical surface presented a problem. The use of fly cutters and a turntable, however, permits the production of the entire spherical portion of the work-piece in a single operation on a vertical milling machine. The setup is here illustrated.

The part A is mounted on a wedge-shaped block B secured to a power driven turntable C. This block holds the work-piece so that its axis is at an angle X with the vertical, and the center of the spherical portion is positioned on the rotational axis of the turntable. The machine spindle is inclined at an angle Y and the milling machine table D is positioned so that the axis of the spindle will pass through the center of the sphere at the completion of the operation. A fly cutter bar E, with inserted cutters set to cut the proper diameter, is employed. Angles X and Y and the setting of the cutters are determined by the size and shape of the part.

For the operation, the turntable is slowly rotated under power and the work is fed horizontally toward the cutter. If the machine has a spindle feed, the cutters may be fed axially to the work. A tool setting gage will simplify readjustment of the fly cutters after grinding.



Setup for machining the spherical portion of workpiece. The part (A) is rotated on a power operated turntable (C) as the fly cutters mill the sphere.

Lead-Screw Dial Locates Lathe Carriage

H. J. GERBER, Stillwater, Okla.

To advance the carriage of a small engine lathe along its bed in precision movements, the end of the lead-screw was fitted with an accurately graduated dial and a knurled knob. In use, the lead-screw is disengaged from the change-gear train, and the half-nuts in the carriage apron are closed around the lead-screw. Then the dial on the end of the lead-screw is rotated manually by means of the knurled knob.

The dial comes in handy for jobs like spacing a series of grooves or shoulders along a shaft or boring a hole to an exact depth. In addition, the dial can be used to read carriage movements while it is in slow power feed.

To adapt the lead-screw, it was removed from the lathe, and the threads near the end (seldom used anyway) were machined down to the end journal size for a distance of about 1 1/4 inches. The support bracket was then moved to the left the same distance and resecured to the bed.

The dial has an integral stem which is bored



To accommodate the dial, last few threads of lead-screw are machined down and support bracket is moved to left.

to fit the end of the lead-screw. A slot along the stem wall and two set-screws provide the clamping means. A pointer is attached to the bottom of the front way.

At the start of a feeding movement, the setscrews are loosened and the dial is rotated independently to a zero setting with the pointer. Then the set-screws are tightened and the dial is bound to the lead-screw.

Multiple-Ball Clamping Compensates for Part Variations

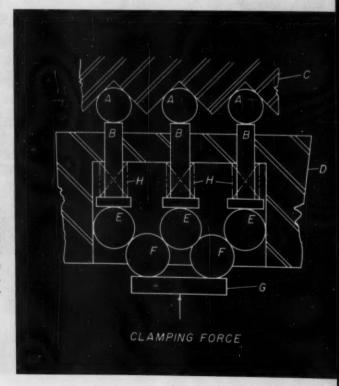
F. C. Elmo, Dayton, Ohio

An effective method of clamping more than one part of a kind for machining, irrespective of small tolerance variations, makes use of multiple balls. The principle here is that pressure applied to the balls will cause them to realign themselves in the face of unequal resistance. A clamping setup designed along this line is illustrated.

Work-pieces A (in this case, cylindrical) are held in position over plungers B by V-grooves in the face of jaw C. The flanged rear ends of the plungers extend into a recess in housing D and are in contact with three steel balls E of bearing quality.

To clamp the work, pressure is applied to balls E through two additional balls F—of like quality—and pressure-plate G. Any size variation that may exist between the parts being clamped will be compensated for by a slight shift in the relative positions of the five balls, thus equalizing the pressure transmitted to the individual work-pieces. Springs H cause the plungers to withdraw upon release of the clamping force.

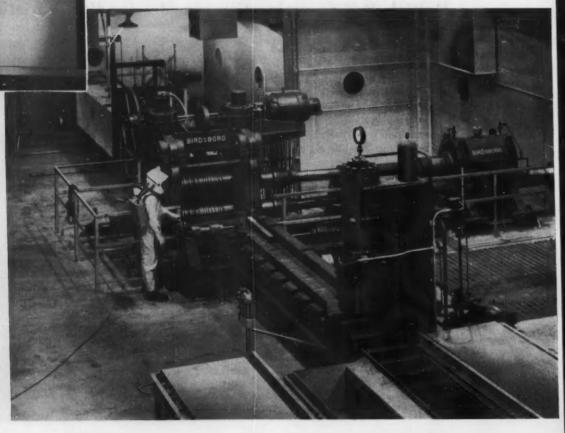
A multiple-ball principle is used in this unit for clamping more than one work-piece. Tolerance variations between the parts are compensated for by a slight shifting of the balls when clamping pressure is applied.



Camera highlights of some interesting operations performed in various metalworking plants throughout the nation by unique applications with modern machines and tools

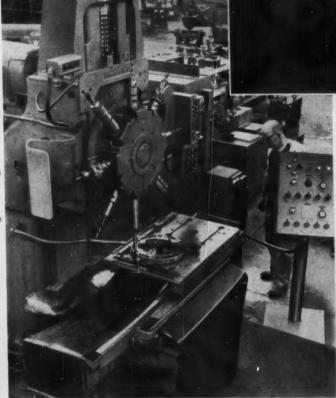
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SPACE-AGE METALWORKING—Men in space suits are producing metals for the Space Age at Universal-Cyclops Steel Corporation, Bridgeville, Pa. Carrying their own oxygen supply with them, technicians impact and roll ingots of refractory metals at temperatures up to 4500 degrees F. in an atmosphere of inert gas. Work site is a new facility called "InFab" (inert fabrication), an isolated steel enclosure within an existing building. (Left) Technician enters through personnel lock, carrying oxygen supply and cooling unit on his back. (Below) Inside enclosure, he observes a bar of molybdenum being hot-worked at 4000 degrees F. on an automatic remote-controlled rolling mill.



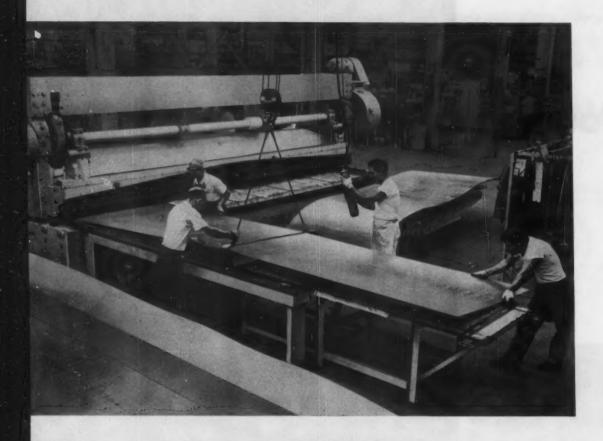
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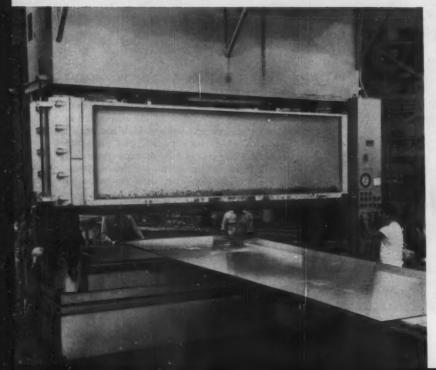




CIRCUIT-BREAKER PLANT—At Trafford, Pa., oil-filled circuit-breakers for electric utility power lines are being built in a new Westinghouse plant. (Above) To impregnate the bushings, they are suspended in clusters and lowered into wells, which are sealed and drawn to a high vacuum, and the parts are then immersed in oil. (Left) A tape-controlled eight-spindle turret drill performs a series of operations on a circuit-breaker part in a programmed machine tool center.

Douglas Fabricates Containers



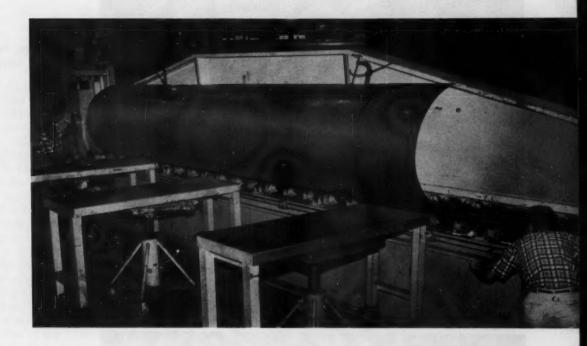


(Above) Using a large Williams-White blanking press to punch patterns of holes simultaneously in sized sheets.

(Left) Sizing sheet stock for the upper shell of a Nike-Zeus shipping container on a Niagara shear.

for Nike-Zeus Missiles

Ground-to-air anti-missile missiles of the Nike-Zeus type are sealed in large airtight containers to prevent any deterioration while awaiting possible use. Operations in fabricating these shipping containers at the El Segundo Division of Douglas Aircraft Co., Inc., are here illustrated.



(Above) Forming the flat sheet into cylindrical shape, ready for welding operation.

(Right) Continuous rolling operation on a Yoder machine reinforces circular ribs of hat-section.

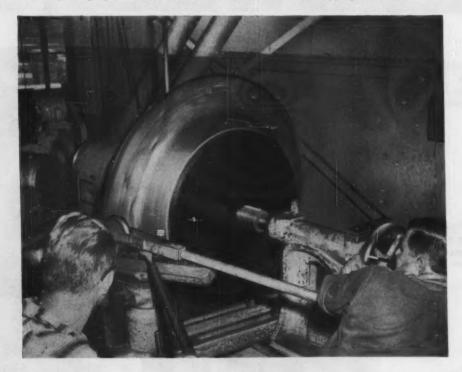


Douglas Fabricates Containers for Missiles (Continued)



Spot-welding the circular hat-section ribs to outside of shipping container.

Spinning operation on a bulkhead for a Nike-Zeus shipping container.



MATERIALS

The properties and new applications of materials used in the mechanical industries

Abrasion-Resistant Die Steel Available in Large Size Range

High resistance to edge wear and chipping is provided by "Darwin No. 1 FM," a high-carbon, high-chromium Type D2 air-hardening free-machining die steel made by Darwin & Milner, Inc., 2222 Lakeside Ave., Cleveland 14, Ohio. Stock sizes now available include rounds from 1/4 to 14 inches, flats from 1/4 by 1/2 inch to 4 by 6 inches, squares from 1/2 inch to 8 inches, and square billets from 4 to 12 inches. The steel is also available in forgings. Its uses include blanking, drawing, forming, coining, and trimming and piercing dies; shear blades; compacting dies and punches; gages; and thread-rolling dies.

The addition of minute, uniformly dispersed alloy sulphides increases machinability as much as 20 per cent over nonsulphurized D2 steel. The sulphide addition also insures a good surface finish and self-lubricating action in dies with no sacrifice in mechanical properties. It hardens at 1800 to 1850 degrees F. Air-cooled hardness is Rockwell C 63 to 65.

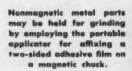
Its high compressive strength and deep hard-

ness give it a fine cutting edge for maximum die life with a minimum of regrinding to maintain die sharpness. The material is tough, yet has nonscaling properties and fair resistance to corrosion. Its typical percentage composition is: C, 1.50; Mn, 0.4; Si, 0.3; Cr, 12.0; Va, 0.90; and Mo, 0.8.

Two-Sided Adhesive Film Used to Hold Work for Grinding

An adhesive film called "Double-Face," used as a means of holding nonferrous metals on magnetic chucks for surface grinding operations, has been announced by the Finishes Division, Interchemical Corporation, 120 Potter St., Cambridge 42, Mass. It is a translucent pressure-sensitive mass in film form, supported by a protective release paper. By applying the film directly to the work, the grinding machine operator can place each piece exactly where he wants it. The grinding surface is not limited as it is with clamps and walls.

Unlike double-coated tapes, the adhesive qualities of the film are not affected by cooling solutions and its use permits closer tolerances be-





cause of its noncushioning effect. A portable applicator enables the operator to apply the film without touching it. A contact roller at the front of the applicator assures a smooth, flat surface with no bubbling. Rolls are available up to 72 yards in length.

Paint and Epoxy-Resin Stripper Used with Water Flush

A nonflammable, alkaline, organic solvent type paint stripper which is designed to first wrinkle paint, enamel, or lacquer coatings, and then allow the wrinkled coatings to be flushed off with water has been brought out by the Mitchell-Bradford Chemical Co., Wampus Lane, Milford, Conn. It will strip a variety of paint coatings and many epoxy-resin type coatings.

"Quick Strip #5," as it is called, can be used in steel tanks or containers over prolonged periods of time without damage to the metal. Stripped surfaces have nominal rust protection

prior to painting.

Thread-Tape Pipe Joint Sealer Made in Four Widths

"Thred-Tape" pipe joint sealer, available in 1/4-, 1/2-, 3/4-, and 1-inch widths, has been announced by Crane Packing Co., Dept. MY-3, 6400 Oakton St., Morton Grove, Ill. Made of chemically inert Du Pont Teflon, it has proved effective for handling acids, caustics, corrosives, biologicals, toxics, and gases. It withstands thousands of pounds of pressure, temperatures of from minus 250 degrees to plus 500 degrees F., and can be used on all types of piping.

To seal a joint, the tape is wrapped around the male threads. The connection is then made in the usual fashion. The tape fills all voids to provide a leakproof seal. It remains permanently plastic, permitting disassembly of connections

even after years of service.

Vacuum-Melted Brazing Alloys Commercially Available

Vacuum-melted brazing alloys, made by the Metallurgical Products Department, General Electric Co., Detroit 32, Mich., are now commer-

cially available.

There are three types of high-strength, high-temperature brazing alloys on the market. One type—the "Wide Gap" series—is capable of bridging joint clearances up to 1/16 inch with a dependable brazed joint. Its use eliminates costly machining operations necessary to achieve the 0.003-inch clearance which is normal for other

types of brazing alloys. It is expected that these alloys will expand the field of brazing to include many applications where welding is now used.

The other two types are "General Purpose Alloys" for general high-temperature brazing and "Honeycomb Brazing Alloys" for brazing metal honeycomb assemblies containing thin (0.001 to

0.005 inch) core materials.

Vacuum melting assures inherent high quality by producing a clean alloy, essentially free from inclusions, undesirable impurities, oxides, and absorbed gases. Such defects can cause inconsistency in brazing performance because of decreased flow, poor wettability, and discontinuities in the brazed joint. Vacuum melting permits close composition control and prevents substantial loss of essential alloying elements which may occur through oxidation or other undesirable reaction during air-melting.

Anti-Seize Thread Compound for Elevated Temperature Use

Felt Products Mfg. Co., 7450 N. McCormick Blvd., Skokie, Ill., has brought out an anti-seize thread compound used to lubricate and seal bolts, studs, flanges, etc. at high pressures, and high temperatures (up to 1800 degrees F.). Called "Fel-Pro C5-A," it has good lubricating and sealing qualities, a low breaking and running torque, is nonsettling and nonhardening, and has a homogenized composition. The compound can be used on all metals, alloys, and plastics, even at temperatures below 32 degrees F. Its use prevents rust and corrosion as well as galling and seizing of threaded surfaces.

High-Strength Nickel-Silicon Bronze with High Ductility

A nickel-silicon bronze alloy composed of 97.5 per cent copper, 1.9 per cent nickel, and 0.6 per cent silicon which may be used for fasteners, swivel joints, marine hardware, switch gear, and wire connectors has been placed on the market by the Bridgeport Brass Co., Bridgeport 2, Conn.

The alloy, called "Nironze 635," exhibits a tensile strength of from 38,000 to 100,00 psi, a yield strength (0.2 per cent offset) of from 10,000 to 85,000 psi, and a hardness of from 7 to 95 on the Rockwell B scale—depending on condition (soft to drawn and aged) of the material.

The alloy is currently available in round rod and wire only, in straight lengths, and coils. It is normally shipped in the solution-treated and cold-drawn condition for subsequent working and aging by the fabricator. For certain applications aged material may be obtained. MACHINERY'S

Reference Section

RELIABILITY— NEW ENGINEERING DIMENSION

When a space "shot" is successful and another satellite goes into orbit, it's a sign that every component, subassembly, assembly, and system in the vehicle has performed its mission reliably. In round numbers, a space vehicle has 300,000 components, every one of which must do its job compatibly with all the others in the system

ROBERT S. CATLIN, Manager, Quality Control, and W. E. COX, Chief, Reliability Norair Division, Northrop Corporation, Hawthorne, Calif.



Reliability-New Engineering Dimension

FEW PROFESSIONAL GAMBLERS would take such odds as 300,000 to 1. Yet our missile contractors are out to win in the face of these odds.

They can state their objective quite simply thus: "The equipment must perform in a satisfactory manner throughout its mission." They realize that the intelligent approach to the problem is to be found by breaking it down to its individual missile parts—all 300,000 of them. To be sure that each of these 300,000 parts is going to do its job, and work in harmony with the other parts of the system, is so big an undertaking that it is really a new engineering concept. The new science is called "reliability engineering."

Depending upon the size of the organization, its method of operation, and the nature of the product, contractors and subcontractors practice reliability engineering slightly differently. Some companies have reliability engineering operating as a staff function, separate from quality control, engineering, and manufacturing structures. Another company may have its reliability department functioning within its engineering department. Still others define reliability as a function of industrial engineering, others place reliability engineering in quality control.

But the objective of reliability operations in all cases is the same: to decrease the incidence of malfunction.

In general, the reliability function seeks to isolate the sources of failures; to establish standards of performance; to establish and control testing

methods, equipment, and environments; to develop methodology; to select material, equipment, and tooling; to establish operator training and certification; to set up statistical quality techniques where applicable; to survey and select competent vendors, and to work with these vendors in product improvement programs; and finally, to collect, interpret, and report test data.

An example of an organization in which reliability is a joint function of engineering and quality control is the Norair Division of Northrop Corporation, Hawthorne, Calif. Here a well-developed quality and reliability engineering program represents an integrated effort which extends from the president of the parent organization through each division and line structure.

The program is administered by a corporate board composed of a senior vice-president and the general managers of each of the three divisions, Fig. 1. This board is supported by a technical advisory council consisting of the chairmen of the division working committees. The council provides lateral communication between the divisions for the analysis and solution of mutual problems. The corporate quality and reliability board establishes policy at the corporate level and coordinates the quality and reliability efforts of each division.

The Norair division quality and reliability board implements corporate policy, establishes division policy, and manages division programs. Division board members are: vice-president and general manager, as chairman, and the managers of engineering, manufacturing, contracts and services, and quality control. The division board assigns the divisional responsibility for quality and reliability functions, resolves problems not decided by the quality and reliability working committee, and reviews the effectiveness of each department's quality and reliability efforts.

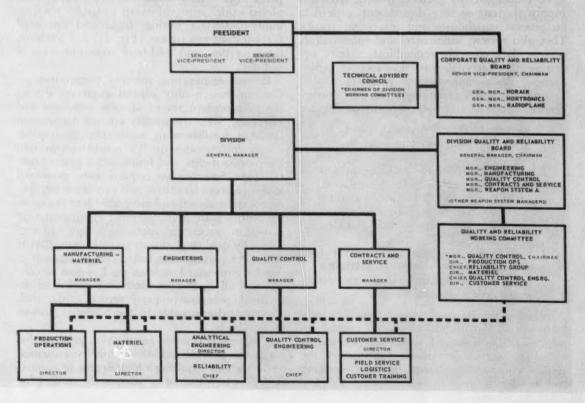
The division quality and reliability working committee, in turn, is responsible for implementing the policy of the division board; developing plans and procedures; reviewing customer quality and reliability requirements; recommending policy improvements; and developing new methods and techniques for maintaining and improving product reliability. Members of the working committee include the manager of quality control as chairman, the chiefs of the engineering reliability group and quality control engineering, and the directors of production engineering, materiel, and customer service.

The working committee reviews and approves all quality and reliability information for release outside of the company, and it monitors all divisional corrective action. This committee provides the area for coordinating the efforts of line organizations, while it also insures that quality and reliability problem areas receive the proper attention in the responsible departments.

The combined quality control and reliability program effects a product contract in its preproduction phases. Quality engineers act in a liaison capacity between the Quality Control Department and the Engineering Department, coordinating quality and reliability activities. This insures the close cooperation essential to an integrated quality program. First-hand knowledge of systems characteristics, gained by participation in test and development programs, places quality engineering personnel in a position to fully evaluate ultimate quality and reliability requirements effectively.

Quality engineers also participate in the classification of characteristics, which aids in establishing acceptance criteria to adequately and economically control incoming products. By transmitting advance information, quality engineers provide adequate lead time for the formu-

Fig. 1. The structure of the company's quality and reliability program represents an integrated effort headed by the president.



MACHINERY'S REFERENCE SECTION



Fig. 2. Preproduction testing activities in the quality control engineering laboratory include accelerated tests of many kinds. Shown here is a system component received from the vendor undergoing a vibration test.

lation and implementation of test and inspection arrangements prior to the time of use.

To round out the picture, quality engineers supply the engineering department with data on process capabilities and inspection results. They also review, summarize, and communicate current data covering requalification tests, operating time accrual, and malfunction experience for design improvement purposes.

Summarized, the functions of the quality engineering coordinator at the Norair division are to:

- Determine the adequacy of quality requirements for inspection and acceptance testing,
- 2. Obtain design and qualification test data for inspection plans formulation.
- Provide classification and variables data requirements on functional equipment for use by inspection planning departments.
- Supply the engineering department with the necessary inspection data for reliability evaluation and design improvement purposes.

Included in the quality and reliability program are all the traditional quality control operations on an enlarged and more penetrating scale. The normal acceptance functions of the quality control department include: receiving and vendor source inspection (Fig. 2); raw

stock control; normal acceptance environmental testing of purchased assemblies (Fig. 3); inplant inspection systems and criteria; a "completed-work" approval-stamp program; compatibility-of-product testing; flight and simulated flight-testing procedures (Fig. 4); and analyses, interpretation, and feed-back communication of test data.

Process engineering receives cooperative assistance from quality control engineers during the development stages of new processes and materials. Thus the quality control department becomes familiar with manufacturing requirements, incorporates quality considerations into the process design, and formulates a process control plan. Specification requirements, personnel and equipment functions, and raw stock requirements are analyzed and integrated into the quality control plan. Manufacturing equipment that is used in any critical operation is surveyed regularly by quality engineers to make sure that it will meet performance tests. Test equipment is regularly examined under a rigid system of control and all equipment must be certified on individual, precision-property record cards, with all standards traceable to the National Bureau of Standards.

A personnel training certification program for craftsmen provides additional quality assurance for operations requiring a high degree of manual skill, or which cannot be adequately verified for quality upon job completion. Over fifty operator training courses are offered in cooperation with the industrial training department under the certification program. Courses in electrical and electronics functional testing, precision soldering, resin and sealant mixing, installation of special fasteners, and other special processes are taught.

Upon the satisfactory completion of a training course, a certificate (Fig. 5) and a stamp are issued which qualify the holder to perform a specific job. Certified operators must undergo recertification examinations at specified intervals to maintain their status.

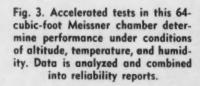
An extensive training program in various advanced skills is also conducted for upgrading operators and to teach new techniques. These courses range from theory and practice in the use of sophisticated test equipment to advanced circuit analysis techniques. Training and certification programs are accomplished by formal classroom courses within the plant, at local schools, and by on-the-job training. The programs are supported by the latest visual and descriptive aids, and by publicity and poster campaigns. No opportunity is overlooked to develop quality and reliability consciousness at all levels.

Extensive acceptance testing is performed on all incoming raw materials by the Norair quality control laboratories. This is backed by further testing, when necessary, at the fabricating levels, then culminating with final acceptance-testing of the end product. Statistical methods are used, whenever applicable, for the analysis, evaluation, and improvement of all phases of the quality and reliability program.

Vendor-vendee relations are an important phase of the quality program. Norair surveys vendors to make sure that they can manufacture, process, and control the quality of specified parts in the volume needed and meet schedules. Vendors are rated and records kept on the quality of products received from them. Periodically, vendor plants are resurveyed to assure their capability of meeting standards. In addition to vendor surveys and rating programs, the quality control personnel assist vendors in the establishment of their own check-lists, classification of characteristics and dimensional controls, and the preparation of variable-data log sheets, Fig. 6.

Quality control aids vendors in setting up their own testing; acts as liaison to improve vendorvendee communications; and helps to expedite corrective action when needed. Norair quality control personnel also cooperate in an associatedvendor program, where a vendor secures parts from outside its own organization, thus assuring depth-integration of the quality control program and also expediting corrective action where needed.

As a part of Norair's over-all control of quality, data systems are maintained for the collection





MACHINERY'S REFERENCE SECTION

and reduction of discrepancy data pertinent to all phases of the quality control program. The function of the data systems is to integrate discrepancy information applying to all phases of the program for the analysis of quality problem areas. Thus it provides a basis for rapidly starting corrective action. Simplified report forms list only pertinent information. Malfunctions are classified by system, subsystem, module, and unit part, in order to isolate the source of a problem. Records are maintained of malfunctions and the corrective action that was required. These data are useful for evaluation purposes at each level of product completion. Where possible, highspeed data-processing equipment is used to provide timely summaries of quality-problem areas. Functions reported by data systems include: failure cause analysis: flight test, MTBF (Mean Time Between Failure) reporting; and a variables data system for the statistical analyses of failure modes.

A quality audit is maintained in the manufacturing cycle. An important part of it is an areameasurement system. The latter is based upon statistical control methods to evaluate quality performance levels of specific manufacturing areas. Each area reporting system is designed to provide accurate and appropriate measurement methods for a given area. Compatible reporting systems are implemented to provide feed-back data on failure or off-tolerance patterns detected by quality control personnel. All area-measurement systems facilitate the integration of the manufacturing quality effort into the over-all quality control program. The audit results in area control charts, known as "quality status reports" (Fig. 7), that provide a graphic comparison of current quality variations with statistically established limits. Limits are based on past performance records. The charts are the official quality-rating records. Because of their easy, graphic interpretation these charts point to trouble areas, minimizing the production of unacceptable parts by prompt indication of when and where a process or production element deviates from an acceptable norm.

Fig. 4. The muffle hangar's control room is fully outfitted with latest equipment needed to monitor and analyze simulated flight performances.



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INDUSTRIAL TRAINING	MATERIALS A PROCESS
7	CONTROL

Fig. 5. A qualification card certifies skilled operators to do work for which they are tested periodically.

Regularly scheduled area quality-reliability meetings are attended by inspection and manufacturing supervisors. They review performance and determine whether the established quality parameters are adequate to evaluate the over-all effectiveness of the quality measurement plan. The meetings also serve to reinforce quality consciousness through constant suggestion.

The quality control-reliability structure at Norair was developed, as outlined, in conjunction with the company's research and development work on the Snark intercontinental missile. In operation, Norair's problem of developing reliability resolved itself into three main questions insofar as management was concerned:

- 1. What is the level of reliability, in measurable terms, that should be agreeable to customer and contractor?
- 2. What program or effort is required to attain this level of reliability at a given date?
- 3. What will the program cost?

From a realistic viewpoint, builders of missiles and their components cannot be expected to achieve 100 per cent reliability, in spite of the rigid quality control systems outlined in this article as typical. At Norair the problem of attaining mutually agreed quantitative reliability has been approached by two methods:

- 1. To make certain of the systems or subsystems redundant.
- Act to prevent recurrence of individual "modes of failure," as revealed by reports and audits.

The use of redundance, which is the application of dual systems for "insurance," has not been popular because the practice requires extra maintenance, adds weight, and requires extra room.

At the present time, however, a trend toward redundance appears likely to develop. This prediction is made because the reliability requirements for space systems to operate for long periods of time appear to be far in excess of the performance that can be attained with nonredundant systems fabricated by present methods. The Snark missile, it should be noted, has no redundant systems or networks.

Action to prevent recurrence of individual "modes of failure" can be regarded as a four-step program to:

- Recognize and identify the modes of failure which require prevention.
- 2. Find out how to prevent or minimize the occurrence of these failures.
- 3. Make successful preventive steps permanent standards.
- 4. Assess the effectiveness of the program over various time intervals.

The key step of this program is the scientific determination of the modes of failure which require prevention.

The engineering, analytical support to the above program also consists of four steps:

1. Determination of the environments and internal loads to which the system will be subjected throughout assembly, handling, operation, and storage. It should include the detailed determination of the applicational loads corresponding to the specific use of the part. This analysis is necessary for the intelligent use of one of the most effective means of reliability improvement: the derating of components.

2. Recognition and identification of those modes of failure under the pertinent environmental and application conditions, once these have been determined. Recognition is based upon a detailed study of the design itself; upon a review of the use of similar items or parts in similar uses; or upon the review of test results of components. Most important is the identification of the possible modes of failure and the selection of those controls in the fabrication and acceptance of the part which will reduce the probability of these failures.

3. Establish component test requirements. These may range from routine qualification tests of items previously used to the testing of statistically significant samples of new items, or old items, to be used in new environments or in new applications.

4. Establishment, in production processes, of inspection and acceptance-test requirements to control or minimize the chance of failure in each of the modes recognized for the equipment.

PRODUCT VERIFICATION SHEET				PART NAME Shaft Angle Generator, Assembly of NG-1					
				PART	NAME	Shaft A	r of H	merator	
NOC	OR ALFEA NEG. CO. NO.	01234		P.O.	NO	09	9-12	145	
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	El Semmio, Calif.					10		704	
11		1717/0		MEJE	CITOM				
-	The Break A division				100	PAGI		OF	
	VENDOR TO CHECK EACH SPECIFICAT SERIAL NUMBER OF PART OR ASSEME BOX N. THIS FORM NUST ACCOMPAN	LY. VENDO	R READING	TE READ!	NGS IN C	OLUMN UN	BER PROF	ER	
0.10	SPECIFICATION SERIAL N	0. V 11	12	13	14	15			
1		V C 61	061	CH	661	-			
1	Hardness Test - RC99-C63	1º C60	260	C60	C 60	C60			
2		VOK	OK	OK	ok	oK			
1	Magnetic Inspection	" OK	OK	OK	ok	oK			
3	, 00000 A	1875	1875	1874	1075	1874	100		
4	18750001 Dia.	1875	1875	1875	1077	1875	[41]		
4	\$.0000 A	74	8448	8499	8777	8499			
+	.84990001 Dia.	Tv.	8499		3418				
5	.39390002 Dia.	M	3937		3938				
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Fig. 6. The variables data collection program gives extra quality assurance by comparing the vendor-determined measuring system with an independent system.

At the present time Norair's engineering philosophy is to prove (through qualification tests) that an item will work. Then it names process controls, inspection tests, and acceptance tests which will assure that any part used in production is similar to the one that passed the tests. From the point of view of reliability, "similar" means identity relative to those details which affect the chances of occurrence of the recognized modes of failure.

Thorough testing identifies modes of failure. Parts and components are tested in exaggerated environments to compensate for lack of "real" time available for actual testing. Attempts are made to induce the same modes of failure as

would occur in a real time of the order of a million hours (about 115 years) of accumulated operational use. Systems and subsystems are also tested, sometimes in exaggerated environments, to cut down the testing time requirements. In these accelerated tests, if there is any failure at all it is grounds for preventive or corrective action. While it is desirable, and often necessary, to duplicate environments in this type of testing, the time duration of the test is a most important factor. Therefore, even though the test is accelerated by exaggerated environment, it must be operated for a time calculated as being long enough to give as many as possible of the modes of failure a chance to occur. Operational-simulation testing

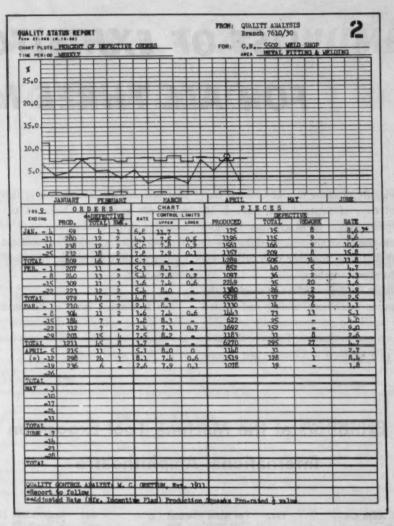


Fig. 7. Typical report, the end result of a Friden data-processing procedure, illustrates periodic changes in the quality level for a given manufacturing operating area.

of systems forms the best means of assessing progress in increasing the mean time between failures.

The scope of the reliability effort, even on presently obsolete weapons systems, is not generally recognized. Cost of attainment of reliability in past and current weapons systems has generally been in the order of a third of the total development cost. This deduction arises from a comprehension of the costs of testing components and systems, the costs of design maintenance to correct malfunctions which occurred, and the costs of making the corrections effective.

From experience obtained in the development of the Snark, Norair believes that the level of reliability of a missile system can be estimated with a satisfactory degree of accuracy. There is a specifically definable means or effort required to achieve the degree of reliability that is attainable now. Further, satisfactory reliability can be accomplished much more rapidly now than in the past. Achieving high reliability is expensive, especially in engineering effort. Cutting down the time of attainment of reliability is proportionately expensive in early development stages. Any system designed to operate for several months, if at all complex, will probably be forced to use redundancy to attain acceptable reliability as long as present fabrication methods continue to be used.

LIST OF EXHIBITORS... FOR ALL THREE METAL-

For readers who are planning to visit Chicago during the eventful days of September 6 through 16, this special 16-page section of MACHINERY provides floor plans of the three metalworking exhibitions to be held there at that time, together with lists of exhibitors and their space numbers.

It may be another five years before so much of the newest and finest in machinery, tooling and related equipment will again be so conveniently available for your inspection and evaluation. To make the most economical use of your time in Chicago, we suggest that you use the information in this section to plan your visit in advance. Note on the floor plans the locations of the exhibits you want to see, and schedule your visits accordingly. You'll get more ideas and greater pleasure by seeing the expositions in this systematic way.

The September issue of Machinery will be devoted almost entirely to descriptions of the machines and equipment which will be in action and on display at all three exhibitions.

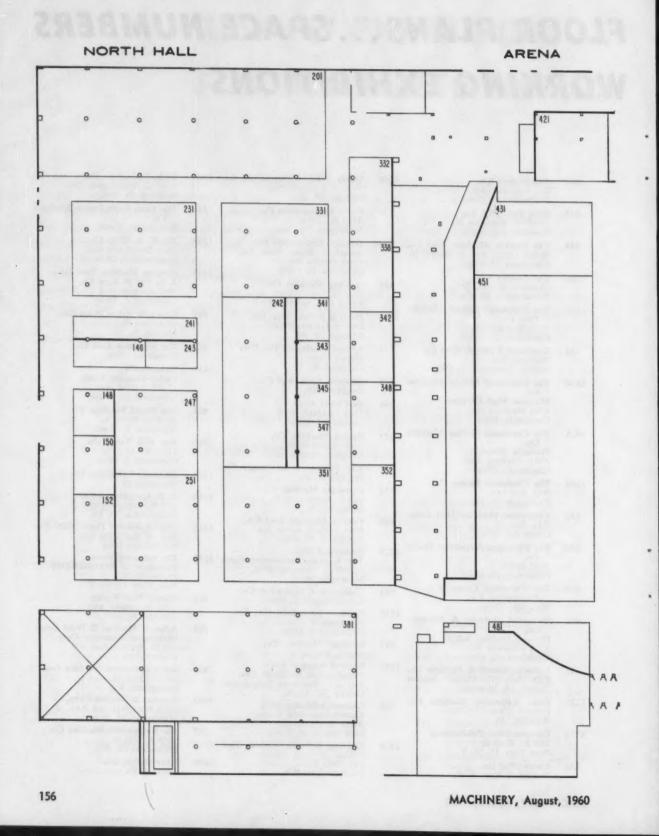
Exhibitors at the Machine Tool Exposition International Amphitheatre

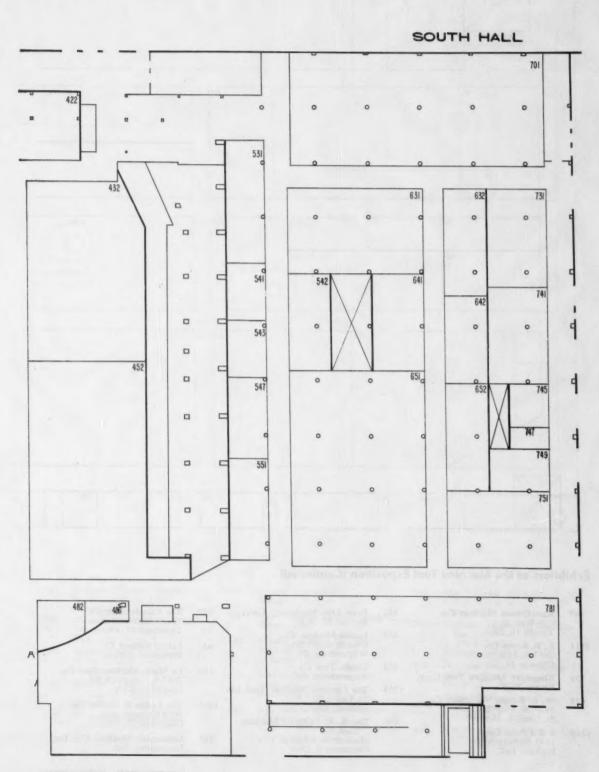
148	Charles G. Allen Co. Barre, Mass.	1142	The Baird Machine Co. 1700 Stratford Ave.	945	Besly-Welles Corp. S. Beloit, Ill.
1120	American Gage Machine Co. Size Control Div. 2500 W. Washington Blvd.	1235	Stratford, Conn. Baker Brothers, Inc. Station F, P.O. Box 101	1209	The Blanchard Machine Co. 64 State St. Cambridge 39, Mass.
381	Chicago 12, Ill. American Tool Works Co. Pearl & Eggleston Aves.	1226	Toledo 10, Ohio Baldwin-Lima-Hamilton Corp. 545 N. Third St.	1325	E. W. Bliss Co. 1375 Raff R., S.W. Canton 10, Ohio
1514	Cincinnati 2, Ohio American Society of Tool & Mfg. Engineers	923	Hamilton, Ohio Barber-Colman Co. Rockford, Ill.	828	Bodine Corp. 317 Mountain Grove Ave. Bridgeport 5, Conn.
	10700 Puritan Ave. Detroit 38, Mich.	741	Bardons & Oliver, Inc. 1133 West 9th St.	1521	Bramson Publishing Co. Box 1
1406	American Steel Foundries		Cleveland 13, Ohio		Birmingham, Mich.
	Elmes & King Divisions Prudential Plaza Chicago 1, Ill.	641	W. F. & John Barnes Co. 301 S. Water St.	452	Brown & Sharpe Mfg. Co. 235 Promenade St.
1531	Anderson Oil & Chemical Co. 211 E. Brownstone Ave. Portland, Conn.	641	Rockford, Ill. John S. Barnes Corp. 301 S. Water St.	936	Providence 1, R. I. Bryant Chucking Grinder Co. 257 Clinton St.
1340	Armstrong-Blum Mfg. Co.		Rockford, Ill.		Springfield, Vt.
	5700 W. Bloomingdale Ave. Chicago 39, Ill.	152	Barnes Drill Co. 814-830 Chestnut St. Rockford, Ill.	551	Buffalo Forge Co. P.O. Box 985
543	Atlantic Machine Tool Works,			1440	Buffalo 5, N. Y.
	Inc. 549 Cedar St. Newington, Conn.	243	Beatty Machine & Mfg. Co. 940—150th St. Hammond, Ind.	1440	Buhr-Sidney Machine Tool Co. 839 Green St. Ann Arbor, Mich.

FLOOR PLANS...SPACE NUMBERS WORKING EXHIBITIONS

834	The Bullard Co. 286 Canfield Ave.	1250	Danly Machine Specialties, Inc. 2100 S. Laramie Ave.	1042	Gisholt Machine Co. 1245 E. Washington Ave.
	Bridgeport 9, Conn.		Chicago 50, Ill.		Madison 10, Wis.
842	Burg Tool Mfg. Co. 15001 S. Figueroa St. Gardena, California	146	Davis & Thompson Co. 4460 N. 124th St. Milwaukee 16, Wis.	348	The Goss & De Leeuw Machine Co. Kensington, Conn.
849	The Carlton Machine Tool Co. Spring Grove Ave. & Meeker St. Cincinnati 25, Ohio	914	American Brake Shoe Co. 1160 Dublin Rd.	1350	The G. A. Gray Co. 3611 Woodburn Ave. Cincinnati 7, Ohio
1536	The Chilton Co. Chestnut & 56th St. Philadelphia 39, Pa.	431	DeVlieg Machine Co. Fair St.	1439	Greaves Machine Tool Div. J. A. Fay & Egan Co. 2011 Eastern Ave. Cincinnati 2, Ohio
1326	The Cincinnati Gilbert Machine Tool Co. 3366 Beekman St. Cincinnati 23, Ohio	1134	Royal Oak, Michigan Dreis & Krump Mfg. Co. 7400 S. Loomis Blvd. Chicago 36, Ill.	541	Greenerd Arbor Press Co. 41 Crown St. Nashua, N. H.
934	Cincinnati Lathe & Tool Co. Marburg Ave.	531	Edlund Machinery Co. Div. Harsco Curp.	486	The Hamilton Tool Co. Hamilton, Ohio
1034	Oakley, Cincinnati 9, Ohio The Cincinnati Milling Machine Co.	846	Cortland, N. Y. Ekstrom, Carlson & Co. Rockford, Ill.	652	Hannifin Div. Parker-Hannifin Corp. 17325 Euclid Ave.
	Machine Tool Division 4701 Marburg Ave. Cincinnati, Ohio	946	Ex-Cell-O Corp. 1200 Oakman Blvd. Detroit 32, Mich.	924	Cleveland 12, Ohio The Heald Machine Co. 10 New Bond St.
1027	The Cincinnati Milling Machine Co. Products Division 4701 Marburg Ave.	331	Famco Machine Co. 3100 Sheridan Rd. Kenosha, Wisconsin	1240	Worcester 6, Mass. The Hill Acme Co. 1201 W. 65th St.
	Cincinnati, Ohio	929	The Fellows Gear Shaper Co. Springfield, Vt.	1506	Cleveland 2, Ohio Hitchock Publishing Co.
1230	The Cincinnati Shaper Co. P.O. Box 111	1122	Ferracute Machine Co.		Wheaton, Ill.
632	Cincinnati 11, Ohio Cleereman Machine Tool Corp. P.O. Box 75	800	429 E. Commerce St. Bridgeton, N. J. Fosdick Machine Tool Co.	1538	E. F. Houghton & Co. 303 W. Lehigh Ave. Philadelphia 33, Pa.
900	Green Bay, Wis.		Blue Rock & Apple Sts. Cincinnati 23, Ohio	1011	The Hydraulic Press Mfg. Co. Div. of Koehring Co.
900	The Cleveland Automatic Mach. Co. 4932 Beech St. Cincinnati 12, Ohio	1220	Frauenthal Div. The Kaydon Engineering Corp. 930 West Sherman Blvd.	1530	Mt. Gilead, Ohio The Industrial Press Publishers of MACHINERY
814	The Cleveland Crane & Engineering Co.	751	Muskegon, Mich. Gallmeyer & Livingston Co.		93 Worth St. New York 13, N. Y.
642	Wickliffe, Ohio	1535	Grand Rapids 2, Mich. Gardner Publishing Co., Inc.	242	Illinois Tool Works 2501 N. Keeler Ave.
642	Cleveland Hobbing & Machine Co. Div. of Textron, Inc.		431 Main St. Cincinnati 2, Ohio	352	Chicago 39, Ill. Johnson Machine & Press Corp
	1311 Chardon Rd. Cleveland 17, Ohio	811	Gardner Machine Co. Beloit, Wis.		Division of Bontrager Corp. 620 W. Indiana Ave. Elkhart, Ind.
241	Colonial Broach & Machine Co. P.O. Box 37—Harper Station Detroit 13, Michigan		General Electric Co. Metallurgical Products Div. Box 237, Roosevelt Park Annex	839	Jones & Lamson Machine Co. 160 Clinton St. Springfield, Vt.
1225	Cone Automatic Machine Co. Everett Lane Windsor, Vt.	345	Detroit 32, Mich. Geometric-Horton Div. United-Greenfeld Corp.	1008	Kearney & Trecker Corp. 6800 West National Ave. Milwaukee 14, Wis.
1522	Conover-Mast Publications 205 E. 42nd St. New York 17, N. Y.	1320	Blake & Valley Sts. New Haven 15, Conn. Giddings & Lewis Machine Tool	347	The Kempsmith Machine Co. 1819 S. 71st St. Milwaukee 14, Wis.
332	Covel Mfg. Co. Benton Harbor, Mich.		Co. 142 Doty St. Fond du Lac. Wis.	1500	Kennametal, Inc. Latrobe, Pa.

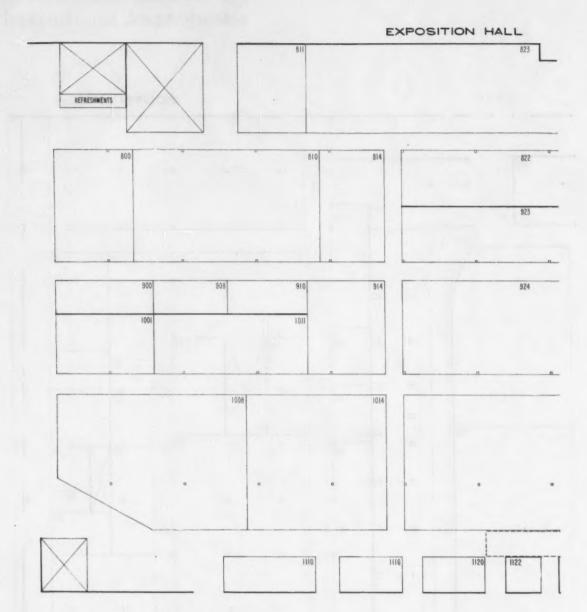
International Amphitheatre





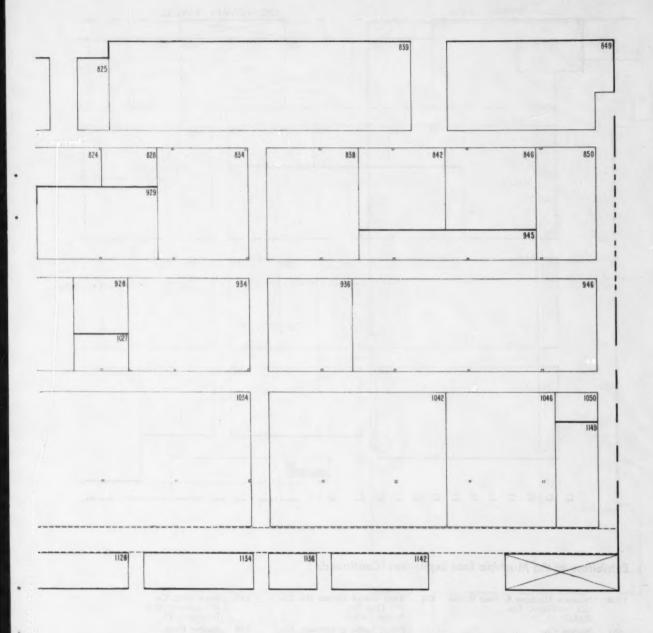
MACHINERY, August, 1960

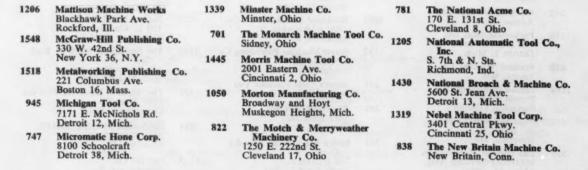
International Amphitheatre

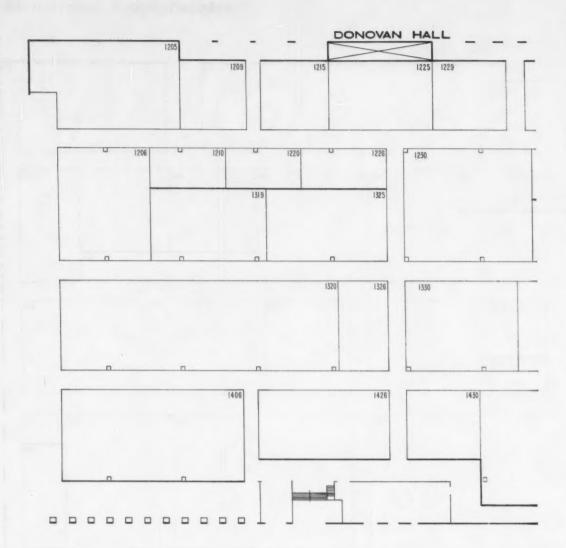


Exhibitors at the Machine Tool Exposition (Continued)

The Lees-Bradner Co. 12120 Elmwood Ave. Cleveland 11, Ohio Lake Erie Machinery Corp. Buffalo 17, N.Y. 547 Kent-Owens Machine Co. 958 Wall St. 542 481 Toledo 10, Ohio Landis Machine Co. .432 1511 L. R. Kerns Co. 2657 E. 95th St. Church & 5th Sts. Waynesboro, Pa. Leland-Gifford Co. 631 Worcester 1, Mass. Chicago 17, Ill. Landis Tool Co. Waynesboro, Pa. 823 Le Maire Machine Tool Co. 2657 S. Telegraph Rd. Dearborn, Mich. 150 731 Kingsbury Machine Tool Corp. Keene, N.H. 1229 The Lapointe Machine Tool Co. 34 Tower St. W. B. Knight Machinery Co. 3920 W. Pine Blvd. St. Louis 8, Mo. The Lodge & Shipley Co. 3055 Colerain Ave. Cincinnati 25, Ohio 1046 Hudson, Mass. The R. K. LeBlond Machine Tool Co. Madison & Edwards Rds. Cincinnati 8, Ohio 810 L & J Press Corp. 1643 Sterling Ave. Elkhart, Ind. 1116 343 Logansport Machine Co., Inc. Logansport, Ind.

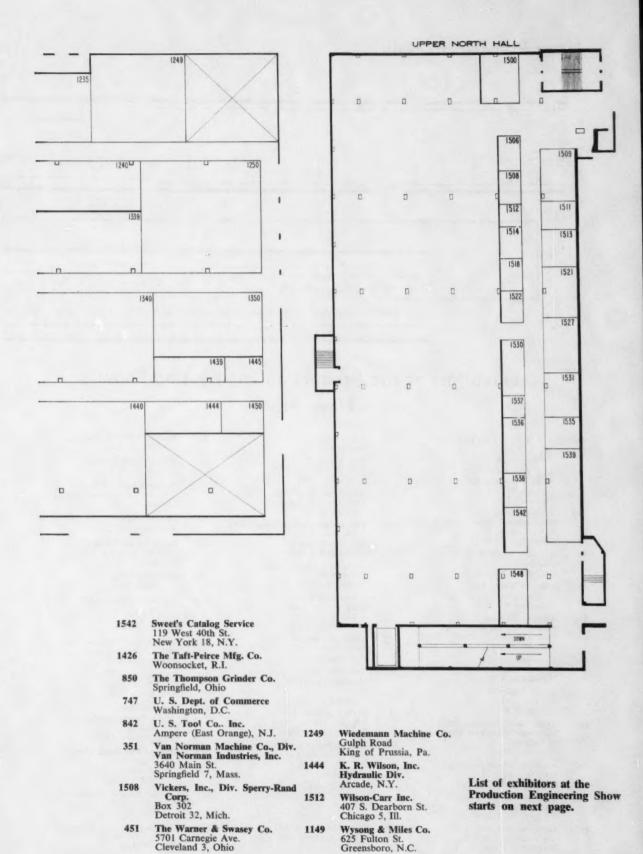




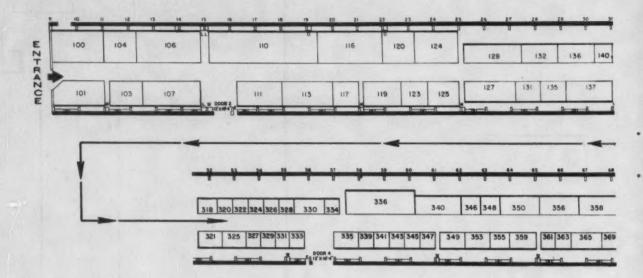


Exhibitors at the Machine Tool Exposition (Continued)

1330	Niagara Machine & Tool Works 683 Northland Ave. Buffalo 11, N.Y.	421	Reed Rolled Thread Die Co. 791 Main St. Holden, Mass.	247	Snow Mfg. Co. 435 Eastern Ave. Bellwood, Ill.
651	Norton Co. Worcester 6, Mass.	1210	Rivett Lathe & Grinder, Inc. 18 Riverview Rd.	910	Snyder Corp. 3400 E. Lafayette Ave.
342	Oliver Instrument Co. Adrian, Mich.	1001	Boston 35, Mass. Rockford Machine Tool Co.	1527	Detroit 7, Mich. Socony Mobil Oil Co.
1136	Parker-Majestic, Inc. 147 Jos. Campau Ave.		2500 Kishwaukee St. Rockford, Ill.		150 E. 42nd St. New York 17, N.Y.
	Detroit 7, Mich.	1532	Screw Machine Publishing Co.	1110	The Springfield Machine Tool
422	Peerless Machine Co. Racine, Wis.		65 Broad St. Rochester 14, N.Y.		631 W. Southern Ave.
1509	Penton Publishing Co. Penton Bldg.	231	Seneca Falls Machine Co. Seneca Falls, N.Y.	1450	Springfield 99, Ohio The Standard Electrical Tool Co.
	Cleveland 13, Ohio	201	The Sheffield Corp.		2488 River Rd. Cincinnati 4, Ohio
482	Pope Machinery Corp. 261 River St.		Springfield St. Dayton 1, Ohio	1014	Sundstrand Machine Tool Co.
	Haverhill, Mass.	341	Sibley Machine & Foundry		2531 Eleventh St. Rockford, Ill.
338	The Portage Machine Co.		Corp.		
	1021-1035 Sweitzer Ave. Akron 11, Ohio		206 E. Tutt St. South Bend 23, Ind.	1513	Sun Oil Co. Philadelphia, Pa.

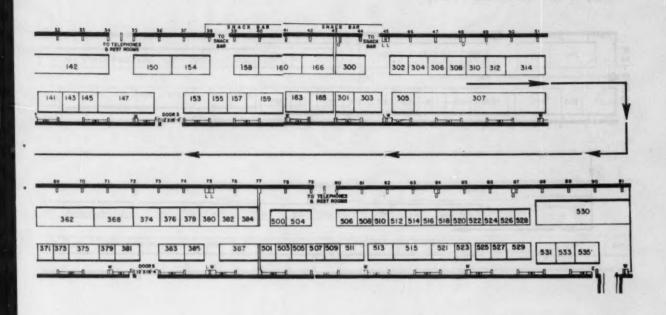


Navy Pier (North Hall)



Exhibitors at the Production Engineering Show Navy Pier

481	A & A Mfg. Co., Inc. 712 S. 12th St.	535	Amp, Inc. Harrisburg, Pa.	528	Boeing Airplane Co. Wichita, Kansas
610	Milwaukee 4, Wis. ACF Electronics Div. ACF Industries, Inc.	460	The Arcair Co. P.O. Box 431 Lancaster, Ohio	123	Boston Gear Works Quincy 71, Mass.
	11 Park Place Paramus, N.J.	238	Armstrong Bros. Tool Co. 5200 W. Armstrong Ave.	423	Breuer Electric Mfg. Co. 5100 N. Ravenswood Ave. Chicago 40, Ill.
306	Acro Division Robertshaw-Fulton Controls Co. 2040 E. Main St.	267	Chicago 46, Ill. The Arrow-Hart & Hegeman Electric Co.	407	The Bristol Co. Waterbury 20, Conn.
300	Columbus 16, Ohio Advance Products Corp.		103 Hawthorne St. Hartford 6, Conn.	601	Brook Motor Corp. 3553 W. Peterson Ave.
	North Shore Drive Benton Harbor, Mich.	204	Associated Spring Corp. 18 Main St.		Chicago 45, Ill.
483	Airmatic Valve, Inc. 7313 Associate Ave.		Bristol, Conn.	252	Browning Mfg. Co. Maysville, Ky.
	Cleveland 9, Ohio	326	Atkins Saw Div. Borg-Warner Corp.	507	Buchanan Electrical Products Corp.
251	Alemite Division Stewart-Warner Corp.		402 S. Illinois Indianapolis 25, Ind.		225 U. S. 22 Hillside, N.J.
l'anton	1826 Diversey Parkway Chicago 14, Ill.	132	Automatic Switch Co. 50-56 Hanover Rd.	244	Buck Tool Company 2015 Schippers Lane
216	Allen-Bradley Co. 1332 S. Second St.		Florham Park, N.J.		Kalamazoo, Mich.
	Milwaukee 4, Wis.	304	Balcrank, Inc. Machine Tool Div.	210	C.I.T. Corp. 650 Madison Ave.
470	Aloris Tool Co. 419 Getty Ave.		Disney St. Cincinnati 9, Ohio		New York, N.Y.
604	Clifton, N.J. American Electronics, Inc. Industrial Machinery Div.	387	Barry Controls, Inc. 700 Pleasant St. Watertown 72, Mass.	427	Cam-Lok Div. Empire Products, Inc. P.O. Box 98
	90 Broadway Norwood, Mass.	373	Sola Electric Co., Div.		Cincinnati 36, Ohio
462	American Metal Forming Co. 3465 W. 140th St.		Basic Products Corp. 4633 W. 16th St. Chicago 50, Ill.	429	Chicago Powdered Metal Products Co. 9700 Waveland Ave.
526	Cleveland 11, Ohio American Screw Co.	530	Bendix Aviation Corp.	236	Schiller Park, Ill.
340	West Main St. Willimantic, Conn.		Industrial Controls Section 21820 Wyoming Detroit 37, Mich.	236	Chicago Rivet & Machine Co. 950 S. 25th Ave. Bellwood, Ill.
480	American Sealants Co. 103 Woodbine St. Hartford 6, Conn.	330	G. S. Blakeslee & Co. 1844 S. Laramie Ave. Chicago 50, Ill.	331	Chicago Reference Book Co. 757 W. 79th St. Chicago 20, Ill.



523	Chicago Tool & Engineering Co. 8383 S. Chicago Ave. Chicago 17, Ill.	
383	Chicago Wheel & Mfg. Co. 1101 W. Monroe Chicago 7, Ill.	
137	The Clark Controller Co. 1146 E. 152nd St. Cleveland 10, Ohio	
227	Clark, Cutler and McDermott Franklin, Mass.	- 3
515	Cogsdill Twist Drill Co. 12950 W. Eight Mile Rd. Oak Park 37, Mich.	
424	Collins Microflat Co. 3249 W. El Segundo Blvd. Hawthorne, Calif.	
321	Commander Mfg. Co. 4225 W. Kinzie St. Chicago 24, Ill.	
457	Corp. Casting Engineers Div. 2323 N. Bosworth Ave. Chicago 14, Ill.	
622	Consolidated Kinetics Corp. 1065 Dublin Rd. Columbus 8, Ohio	
258	Copy-Craft, Inc. 105 Chambers St. New York 7, N.Y.	
454	Arthur A. Crafts Co., Inc. 603 Newbury St. Boston 15, Mass.	
10-0	AND THE RESIDENCE OF THE PARTY	

443	Crown Tool, Inc. 810 N. Cass St. Wabash, Ind.	406	R. B. Denison Mfg. Co. 386 Broadway Bedford, Ohio
307	Crucible Steel Co. of America P.O. Box 2518 Pittsburgh 30, Pa.	230	Devcon Corp. Endicott St. Danvers, Mass.
529	The Cuno Engineering Corp. 80 S. Vine St. Meriden, Conn.	336	The DeVilbiss Co. 300 Phillips Ave. Toledo 1, Ohio
378	Curtiss-Wright Corp., Marquette Div. 1145 Galewood Drive	264	Die-Draulic Grip, Inc. 1440 Front Ave., N. W. Grand Rapids 4, Michigan
128	Cleveland 10, Ohio The Cushman Chuck Co.	136	Diehl Mfg. Co. Finderne Plant Somerville, N.J.
142	Hartford 2, Conn. Cutler-Hammer, Inc. 315 N. 12th St.	116	The DoAll Co. 254 N. Laurel St. Des Plaines, Ill.
211	Milwaukee 1, Wis. Dake Corp. 724 Robbins Rd.	302	Durant Mfg. Co. 1929 N. Buffum St. Milwaukee 1, Wis.
256	Grand Haven, Mich. Dazor Mfg. Corp.	381	Eagle Signal Company 202-20th St. Moline, Ill.
477	St. Louis 10, Mo.	614	Eclipse Machine Div. The Bendix Corp.
4//	De Van-Johnson Co. 507 Rathbone Ave. Aurora, Ill.	234	Elmira, N.Y. Eldridge Co.
607	De Vry Technical Institute 4141 Belmont Ave.	606	1608 Summer St. Philadelphia 3, Pa. Electro Dynamic Div.
223	Chicago 41, Ill. Delco Products Div.	000	General Dynamics Corp. Bayonne, N.J.
	General Motors Corp. 329 E. First St. Dayton 1, Ohio	379	Empire Corp. 1566 S. 83rd St. Milwaukee 14, Wis.

468

Deluxe Coils, Inc. 1300 First St. Wabash, Ind.

441

Walter Cronan Co. 110 Wall St. New York 5, N.Y.

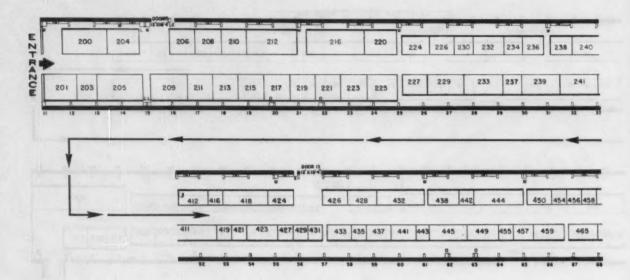
Cramer Controls Corp. Box 7 Centerbrook, Conn.

456

472

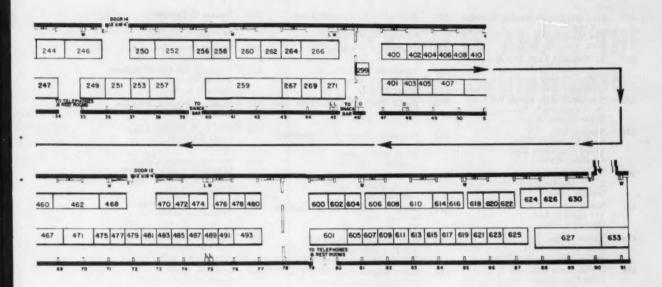
Enco Mfg. Co. 4520-26 W. Fullerton Ave. Chicago 39, Ill.

Navy Pier (South Hall)



Exhibitors at the Production Engineering Show (Continued)

335	Encyclopaedia Britannica 185 N. Wabash Ave. Chicago 1, Ill.	500	Field Abrasive Mfg. Co. 1303 Stanley Ave. Dayton, Ohio	432	Hammond Machinery Bullders, Inc. 1600 Douglas Ave.
363	Engineered Electronics Co. P.O. Box 659 Santa Ana, Calif.	325	Formsprag Co. 23601 Hoover Rd. Van Dyke, Mich.	368	Kalamazoo, Mich. Hevi-Duty Electric Co. P.O. Box 563
467	Engis Equipment Co. 431 S. Dearborn St. Chicago 5, Ill.	334	Friden, Inc. 2350 Washington Ave. San Leandro, Calif.	348	Milwaukee, Wis. Haydon Div. General Time Corp.
247	Etteo Tool Co. 594 Johnson Ave. Brooklyn 37, N.Y.	511	Furnas Electric Co. 1000 McKee St. Batavia, Ill.		245 E. Elm St. Torrington, Conn.
350	Fairbanks, Morse & Co.	346	Gaertner Scientific Corp.	318	F. Ward Harman Associates Halesite, L.I., N.Y.
	600 S. Michigan Ave. Chicago, Ill.		1201 Wrightwood Ave. Chicago 14, Ill.	349	Hitchiner Mfg. Co., Inc.
217	The Fafnir Bearing Co. 37 Booth St. New Britain, Conn.	512	Gast Mfg. Corp. 146 Water St. Benton Harbor, Mich.	408	Milford, N.H. Hoffman Engineering Corp. Anoka, Minn.
103	Farrand Controls, Inc. 4401 Bronx Blvd. New York 70, N.Y.	521	General Automation Corp. 40-66 Lawrence St. Flushing 54, N.Y.	165	The Holo-Krome Screw Corp. P.O. Box 98 Hartford 10, Conn.
209	Farrington Mfg. Co. Industrial Park Needham, Mass.	110	General Electric Co. 1 River Rd. Schenectady 5, N.Y.	433	Hyatt Bearings Div. General Motors Corp. Harrison, N.J.
224	Fawick Airflex Co., Inc. 9919 Clinton Rd. Cleveland 11, Ohio	630	General Radio Co. West Concord, Mass.	450	The Imperial Brass Mfg. Co. 6300 W. Howard St.
310	The Federal Bearings Co., Inc. Poughkeepsie, N.Y.	205	Gilman Engineering & Mfg. Co. 305 W. Eastern Ave.	140	Chicago 48, Ill.
445	Federal Pacific Electric Co. 50 Paris St.	339	Janesville, Wis.	140	Imperial Stamp & Engraving Co. 8258 N. Christiana Ave. Skokie. Ill.
359	Newark 1, N.J. The Felters Co.	339	GraFlex Corp. 154 Clarissa St. Rochester, N.Y.	458	Industrial East Co.
339	210 South St. Boston, Mass.	303	Graham Transmissions Inc.		Box 561 Clifton, N.J.
437	Fenway Machine Co., Inc.	220	Menomonee Falls, Wis.	624	Inspection Control Corp. Lake City, Mich.
	3107 N. Broad St. Philadelphia 32, Pa.	320	Green Instrument Co., Inc. 385 Putnam Ave. Cambridge 39, Mass.	428	International Business Machines
246	Ferguson Machine Corp. 7818 Maplewood Industrial Ct. St. Louis 17, Mo.	154	Hamilton Mfg. Co. Two Rivers, Wis.		Corp. 590 Madison Ave. New York, N.Y.



11	West Hartford 10, Conn.	426	The Lufkin Rule Co. 1730 Hess Ave. Saginaw, Mich.	418	Micrometrical Mfg. Co. 345 S. Main St. Ann Arbor, Mich.
32	4 Janette Electric Mfg. Co. Lehigh at Main Morton Grove, Ill.	605	Luxo Lamp Corp. Dock St.	145	Micro-Poise Engineering & Sales Co.
20	Jerico, Inc. 4744 W. Lake St. Chicago 44, Ill.	459	Port Chester, N.Y. Machinery Electrification, Inc.	271	14851 Grand River Detroit 27, Mich. Micro Switch Div.
49		341	35 Hudson St. Northboro, Mass.	2/1	Minneapolis-Honeywell Regulator Co.
62	Royal Oak, Mich. 6 Kellems Co.	341	MacRae's Blue Book 18 E. Huron St. Chicago 11, Ill.		Chicago & Spring Sts. Freeport, Ill.
	15 William St. Stonington, Conn.	400	Magnaflux Corp. 7300 W. Lawrence Ave.	106	Miller Fluid Power Co. Div. Flick-Reedy Corp. Bensenville, Ill.
11	1 Kennametal Inc. Latrobe, Pa.	486	Chicago 31, III.	269	Minneapolis-Honyewell Regu-
50	The Korfund Co. 48-15 32nd Place Long Island City, N.Y.	476	Manheim Mfg. & Belting Co. Manheim, Pa.		Machine Controls Div. 2753 Fourth Ave., S.
26		249	Marathon Electric Mfg. Corp. Wausau, Wis.	308	Minneapolis 8, Minn. Mo-Bar Hydraulic Sales Co.
1	Detroit 2, Mich.	125	Marlin-Rockwell Corp. Chandler St.	328	Crystal Lake, Ill. Modern Mfg. Co., Inc.
1.	P.O. Box 6800-A Chicago 80, Ill.	371	Jamestown, N.Y. Martin Engineering Co.	020	680 Davisville Rd. Willow Grove, Pa.
61	110 Ionia Ave., N. W. Grand Rapids 2, Mich.	253	Neponset, Ill. Marvel Engineering Co. 7227 N. Hamlin Ave.	206	Moog Servocontrols, Inc. Proner Airport East Aurora, N.Y.
2	The Lima Electric Motor Co. Findley Rd. Lima, Ohio	455	Chicago 45, Ill. May-Fran Engineering, Inc. 1710 Clarkstone Rd.	402	Morrison Engineering Co. 933 W. Lake St. Chicago 7, Ill.
2:	25 Lindberg Engineering Co. 2450 Hubbard St., W. Chicago, Ill.	213	Cleveland 12, Ohio McGill Manufacturing Co. Valparaiso, Ind.	299	National Diamond Labs. 619 Saint St. Peekskill, N.Y.
3	33 Lowell Industries, Inc. Allston Station Boston 34, Mass.	606	The Metal Removal Co. 1801 W. Columbia Ave. Chicago 26, Ill.	479	National Equipment Rental Ltd P.O. Box 165 Floral Park, N.Y.
4	75 Lubriquipment Engineers, Inc. P.O. Box 9194 Fort Worth 7, Texas	131	McGraw-Hill Publishing Co. 330 W. 42nd St. New York 36, N.Y.	133	New Departure Div. General Motors Corp. Bristol, Conn.

Exhibitors at the Production Engineering Show (Continued)

431	New Hermes Engraving Machine Corp. 154 W. 14th St.	514	Productive Equipment Corp. 2926-28 W. Lake St. Chicago 12, Ill.	100	Square D Company 4041 N. Richards St. Milwaukee 12, Wis.
487	New York 11, N.Y. L. Newman Tool, Die &	410	Production Machine Co. Greenfield, Mass.	345	Stahlin Bros., Inc. Belding, Mich.
407	Machine Works 1001 24th St. Oakland 7, Calif.	405	PurOlator Products, Inc. 970 New Brunswick Ave. Rahway, N.J.	471	Standard Oil Co. of Indiana 910 S. Michigan Ave. Chicago 5, Ill.
503	Nichols-Morris Corp. 76 Mamaroneck Ave. White Plains, N.Y.	143	Redin Production Machine Co. 2433 20th St.	232	Standard Pressed Steel Co. Jenkintown, Pa.
221	Norden Div. United Aircraft Corp. 13210 Crenshaw Blvd.	411	Rockford, Ill. Reliance Electric & Engineering Co.	150	The L. S. Starrett Co. 1-165 Crescent St. Athol, Mass.
385	Gardena, Calif. North Electric Co.		24701 Euclid Ave. Cleveland 17, Ohio	465	Stewart-Warner Corp. Industrial Balancer Dept.
363	551 S. Market St. Galion, Ohio	305	J. A. Richards Company 903 N. Pitcher St. Kalamazoo, Mich.		1826 Diversey Parkway Chicago 14, Ill.
416	Northwestern Tools, Inc. 117 Hollier Ave. Dayton 3, Ohio	117	Roller Bearing Co. of America Sullivan Way West Trenton, N.J.	327	Sunnen Service Corp. 7910 Manchester Ave. St. Louis 17, Mo.
474	Nylok Corp. 8046 Central Park Skokie, Ill.	220	Ross Operating Valve Co. 120 E. Goldengate Detroit, Mich.	226	Supreme Products Corp. 380 Madison Ave. New York 17, N.Y.
259	O'Neil-Irwin Mfg. Co. Lake City, Minn.	166	Rowe Machinery & Mfg. Co. 811 Regal Row	163	Synthane Corp. River Road
501	Onsrud Cutter Mfg. Co. 800 E. Broadway Libertyville, Ill.	508	Dallas 35, Texas RoyEl Tools P.O. Box 7486 Minneapolis 22, Minn.	329	Oaks, Pa. The Tap Cartridge Co. P.O. Box 1017 Cincinnati 1, Ohio
412	Opto-Metric Tools, Inc. 137 Varick St. New York 13, N.Y.	376	The Ruthman Machinery Co. 1809 Reading Rd. Cincinnati 2. Ohio	157	Tapmatic Corp. 845 W. 16th St. Costa Mesa, Calif.
375	The Osborn Mfg. Co. 5401 Hamilton Ave. Cleveland 14, Ohio	403	Safety Socket Screw Co. 6501 North Avondale Ave. Chicago 31, Ill.	510	Tecnica Corp. 27-11 41st Ave.
435	Owatonna Tool Co. 383 N. Cedar St. Owatonna, Minn.	104	Saginaw Steering Gear Div. General Motors Corp. 3900 Holland Ave.	160	Long Island City 1, N.Y. G. H. Tennant Co. 701 N. Lilac Drive
491	Ozalid, Division of General Aniline & Film Corp. Ansco Rd. Johnson City, N.Y.	505	Saginaw, Mich. Sargent and Company Hand Tool Division New Haven, Conn.	374	Minneapolis 22, Minn. Texas Instruments, Inc. Semi-Conductor Components Div.
602	Paramount Textile Machinery Co. 131 S. Wabash Ave.	322	Schauer Manufacturing Corp. 4500 Alpine Ave.		P.O. Box 312 Dallas, Tex.
489	Chicago 3, Ill. Parker-Kalon Div. General American Transporta-	356	Cincinnati 36, Ohio Scherr-Tumico Chicago Co. 5045 W. Harrison St.	504	Textron Electronics, Inc. M-B Electronics Div. 781 Whalley Ave. New Haven, Conn.
158	tion Corp. Clifton, N.J. Penton Publishing Co.	233	Chicago, Ill. Geo. T. Schmidt, Inc. 4100 Ravenswood Ave.	314	The Timken Roller Bearing Co 1835 Dueber Ave., S. W. Canton 6, Ohio
	1213 W. Third St. Cleveland 13, Ohio	229	Chicago 13, Ill. Scully-Jones and Co. 1901 S. Rockwell St.	219	Toledo Scale Division Toledo Scale Corp. Telegraph Rd.
438	Phillips Mfg. Co. 3475 W. Touhy Ave. Chicago 45, Ill.	240	4258 N. Knox Ave.	401	Toledo 12, Ohio Torit Mfg. Co.
266	Pines Engineering Co., Inc. 601 Walnut St. Aurora, Ill.	404	Chicago 41, Ill. Sigmamotor, Inc. 3 N. Main St.	155	
201	Pivot Punch & Die Corp. 1254 Erie Ave. North Tonawanda, N.Y.	212	Middleport, N.Y. The Skinner Chuck Co.	442	28815 Aurora Rd. Solon, Ohio Troyke Mfg. Co.
369		239	95 Edgewood Ave. New Britain, Conn. A. O. Smith Corp.		11294 Orchard St. Cincinnati 41, Ohio
358	South Gate, Calif.	269	Milwaukee 1, Wis.	106	Tru-Seal Division Flick-Reedy Corporation Bensenville, Ill.
	1033 Sweitzer Ave. Akron 11, Ohio	269	1048 Potomac St., N. W. Washington 7, D.C.	449	
625	Precise Products Corp. 3715 Blue River Rd. Racine, Wis.	419	Specialties, Inc. Skunks Misery Rd. Syosset, L.I., N.Y.	208	Twin Disc Clutch Co. 1328 Racine St. Racine, Wis.

- Union Mfg. Co. 296 Church St. New Britain, Conn.
- 241 The U. S.-Burke Machine Tool Div. Brotherton Rd. & Penn. R.R. Cincinnati 27, Ohio
- 159 U.S. Electrical Motors, Inc. Box 2058, Terminal Annex Los Angeles 54, Calif.
- 312 U. S. Leasing Corporation 580 California St. San Francisco 4, Calif.
- 119 United States Rubber Co. Mechanical Goods Div. 1230 Ave. of Americas New York 20, N.Y.
- 627 Valenite Metals, Div. Valeron Corp. Box 205 Royal Oak, Mich.
- 124 Vascoloy-Ramet Corp. 800 S. Market St. Waukegan, Ill.
- 107 Vickers, Inc. 1400 Oakman Blvd. Detroit 32, Mich.
- 347 The E. H. Wachs Co. 1525 N. Dayton St. Chicago 22, Ill.
- 260 Wagner Electric Corp. 6400 Plymouth Ave. St. Louis 33, Mo.
- 340 Wales Strippitt, Inc. Akron, N.Y.
- 509 Wang Laboratories, Inc. 12 Huron Dr. Natick, Mass.
- 444 Warner Electric Brake & Clutch
 Co.
 Beloit, Wis.
- 355 Watts Regulator Company Lawrence, Mass.
- 624 Wedin Corp. Cadillac, Mich.
- 237 Welduction Corporation 19400 W. 8 Mile Rd. Detroit, Mich.
- Weltronic Co. 19500 W. Eight Mile Rd. Southfield, Mich.
- 380 Wesco Tool, Inc. 2820 San Fernando Blvd. Burbank, Calif.
- 301 Westinghouse Air Brake Co. Industrial Products Div. P.O. Box 36 Wilmerding, Pa.
- 101 Westinghouse Electric Corp. P.O. Box 868 Pittsburgh 30, Pa.
- 361 Wilson Mechanical Instrument Div. Amercian Chain & Cable Co.. 929 Connecticut Ave. Bridgeport 2, Conn.
- 421 Wilton Tool Mfg. Co., Inc. 9525 Irving Park Rd. Schiller Park, Ill.
- 250 The Zero-Max Co. 1900 Lyndale Ave. S. Minneapolis 5, Minn.

QUICK FACTS ABOUT THE CHICAGO EXHIBITIONS

MACHINE TOOL EXPOSITION

International Amphitheatre 43rd and S. Halsted St. September 6-16, 1960

PRODUCTION ENGINEERING SHOW

Navy Pier Foot of Grand Avenue September 6-16, 1960

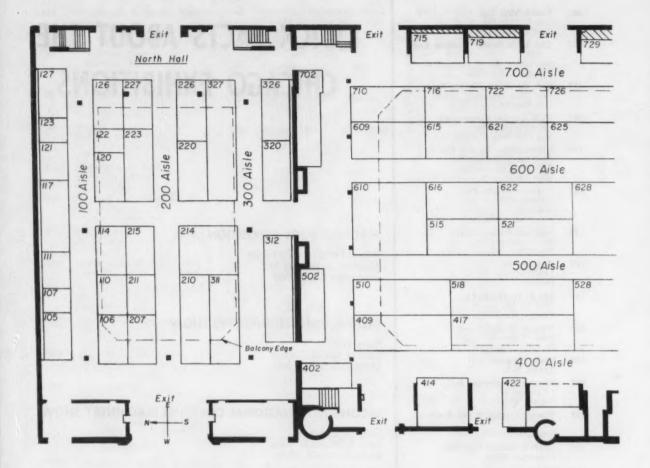
SECOND INTERNATIONAL COLISEUM MACHINERY SHOW

Chicago Coliseum 1513 S. Wabash Ave. September 7-15, 1960

Registration at either the Production Engineering Show or the Machine Tool Exposition provides admission at any time to either show. Scheduled buses will run between the Navy Pier and the International Amphitheatre. Hours of the Production Engineering Show will be dovetailed with those of the Machine Tool Exposition, so that visitors can utilize their time to the fullest.

List of exhibitors at the Coliseum Machinery Show starts on next page.

Chicago Coliseum



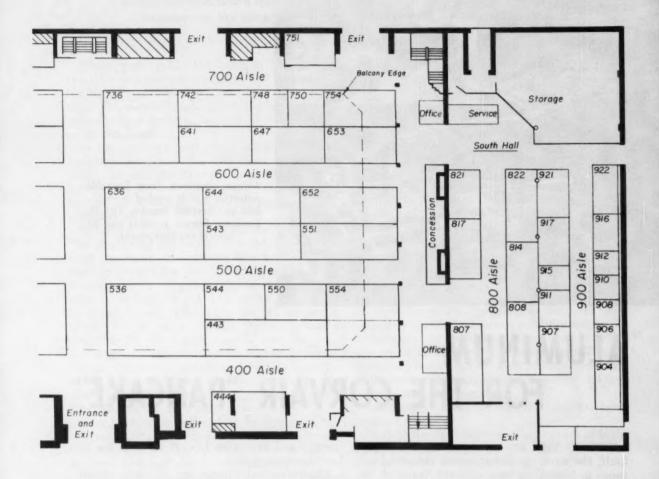
Exhibitors at the Coliseum Machinery Show

- Allied Mfg. & Sales Co. 3101 W. Grand Ave. Chicago 22, Ill.
 American Pullmax Co., Inc. 2455 N. Sheffield Ave. Chicago 14, Ill.
- 123 Antares Instruments, Inc. 5502—37th Ave. Woodside 77, N. Y.
- 736 Atlas Press Co. 1915 N. Pitcher St. Kalamazoo, Mich.
- 551 Barer Engineering & Machinery Co., Ltd. 1365 Basin St. Montreal 3, Canada
- 916 R. Beorgeois & Cie.
 Usine de Trepillot
 Besançon (Doubs) France
- 121 Cawi Machine Co. 34 Exchange Pl. Jersey City 2, N.J.
- 502 Cazeneuve Salse Co. 755 Pennsylvania Ave. San Francisco 7, Calif.

- 652 Columbia International Corp. 10-35 Forty Fourth Drive Long Island City, N. Y.
- 107 Comet Industries 9865 Franklin Ave. Franklin Park, Ill.
- 722 Corpet Louvet & Cie. 6, rue Gambetta, 6 La Courneuve (Seine), France
- 117 Cosa Corp. 405 Lexington Ave. New York 17, N. Y.
- 550 Crane Packing Co. 6400 Oakton St. Morton Grove, Ill.
- 751 Decherts 713 W. Main St.
- Palmyra, Pa.

 719 Diamond Saw Works, Inc.
 Caffee, N. Y.
- 528 The DoAll Co. 254 N. Laurel Ave. Des Plaines, Ill.
- 726 Elox Corp. of Mich. Royal Oak, Mich.

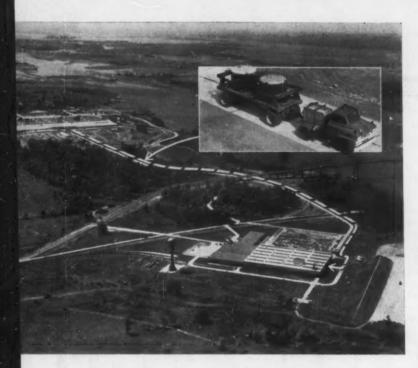
- 515 The Fenn Mfg. Co. Fenn Road Newington, Conn.
- 518 Gisholt Machine Co. 1245 E. Washington Ave. Madison 10, Wis.
- 641 Grob, Inc. Grafton, Wis.
- 110 E. G. Hellers Son, Inc. 7039 E. Slauson Ave. Los Angeles 22, Calif.
- 710 Hermes Machine Tool Co. 48-15 Northern Blvd. Long Island City, N. Y.
- 215 I. O. Johansson Co. 2248 St. Louis Ave. Skokie, Ill.
- 521 The Lapointe Machine Tool Co. 34 Tower Ave. Hudson, Mass.
- 127 Lennox Tool & Machine Builders 651 N. Baxter St. Lima, Ohio



- 554 Le Progres Industriel
 Jones & Lamson Machine Co.
 S.A.
 Avenue Huysmans 44
 Lot, Belgium
- 750 Machinery Dealers National Ass'n.
 1346 Connecticut Ave., N. W. Washington 6, D. C.
- 417 Marac Machinery Corp. 108 Grand St. White Plains, N. Y.
- 211 Mercuria Co. 156 Burlington Ave. Clarendon Hills, Ill.
- 114 Merrill Brothers 56-02 Arnold Ave. Maspeth 78, N. Y.
- 543 Mitsubishi International Corp. 606 S. Hill St. Los Angeles 14, Calif.
- 320 Mitts & Merrill, Inc. 1009 S. Water St. Saginaw, Mich.
- 910 Nationwide Engineering Service 6138 W. Washington St. Culver City, Calif.

- 609 Olivetti Corp. of America 42-33 Northern Blvd. Long Island City 1, N. Y.
- 122 Pathex, Ltd. 420-430 Main St. Buffalo 2, N.Y.
- 105 Powermatic Machine Co.
 Box 70
 McMinnville, Tenn.
- 647 Retor Developments, Ltd. Argyll Road Gault, Ont., Canada
- 443 S & S Machinery Co. 140-53rd St. Brooklyn 32, N. Y.
- 610 Sigma Machinery Co. Two Park Ave. New York 16, N. Y.
- 821 Speedlap Corp. 8022 N. Monticello Ave. Skokie, Ill.
- 520 Spitfire Tool Machine Co. 2931-35 N. Pulaski Road Chicago 41, Ill.
- 210 South Bend Lathe, Inc. South Bend 22, Ind.

- 326 Stone Machinery Co., Inc. Manlius, N.Y.
- 510 Tree Tool & Die Works 1600 Junction Ave. Racine, Wis.
- Uniloy, Inc. 135 E. Bennett St. Saline, Mich.
- 748 Universal-Automatic Corp. 9545 Ainslie St. Schiller Park, Ill.
- 402 Upton, Bradeen & James, Inc. 890 Yonge St. Toronto 5, Ont., Canada
- Wells Mfg. Corp. 407 E. Jefferson St. Three Rivers, Mich.
- 715 W. F. Wells & Sons Three Rivers, Mich.
- Wickman Mfg. Co. 10325 Capitol Ave. Oak Park 37, Mich.
- 223 Winslow Product Engineering Corp. 47 St. Joseph St. Arcadia, Calif.



Molten aluminum from Reynolds reduction mill is trucked in crucibles to Chevrolet foundry. The St. Lawrence Seaway complex can be seen in the background.

ALUMINUM FOR THE CORVAIR "PANCAKE"

NEXT TO THE St. Lawrence Seaway project itself, the most significant recent industrial advance in New York State's "North Country" has been the erection of the huge, modern aluminum reduction plant of the Reynolds Metals Co. on the flank of the also new and modern Chevrolet-Massena aluminum foundry. Equally significant is the fact that the two plants are tied together with a private road over which, twenty-four hours a day, 365 days a year, is transported molten aluminum produced by one and cast into automotive components by the other. This molten-metal concept is credited with putting aluminum in automobiles on an accelerated quantity and long-range basis.

The St. Lawrence reduction plant is Reynolds' eighth aluminum-making facility. On its completion, early this year, it added 100,000 tons to the company's primary-producing capacity, bringing its total to 701,000 tons per year. Although all three of the plant's pot lines have been installed, only two have been activated. These are operating at full capacity, producing metal at the rate of 67,000 tons annually. The reduction mill is located less than a mile away from the

foundry and five miles from the site of the St. Lawrence power dam.

The three installations are mutually advantageous: Reynolds is assured of a long-term source of firm power, which is essential to the aluminum-reduction process, and a ready outlet for about one-third of the plant's production in the form of molten-metal deliveries to the neighboring foundry. Chevrolet receives a continuous flow of molten metal, so important to the efficient mass production of a whole range of aluminum castings for the Corvair engine. And the New York State Power Authority, which administers the United States phase of the power program, has a thirty-three-year contract with Reynolds for the purchase of 27 per cent of its entire output of 735,000 kilowatts of firm power.

The fact that the metal is delivered in a molten state is significant because it really represents two products—heat as well as metal. The user does not have to supply the large amounts of heat that would be necessary if the incoming metal were ingots or billets. The molten product is especially useful to the automotive industry which requires large, continuous quantities.

An industrial triad composed of a hydroelectric power source, a reduction mill, and a foundry—all at Massena, N. Y., on the St. Lawrence Seaway—is the progenitor of Chevrolet Corvair aluminum engines

Trucks pick up the hot metal in 9000-pound crucibles and carry it over the road connecting the two plants. The trip takes about seven minutes. The metal, which enters the crucibles at around 973 degrees C., retains its molten form up to two hours.

In the reduction mill, there are six pot-room buildings to house the 504 electrolytic cells which comprise the three pot lines. The cells are arranged eighty-four to a building, each pot line housing 168 cells and occupying two buildings,

1300 feet long.

Several new techniques have been introduced. The pot rooms are two-story buildings, so that fresh air comes up from the first floor through gratings around the pots, reducing the ambient temperature. A pot puncher breaks crust formations at the top of a pot. This device is operated by a jack handle, whereas in the old method a worker had to use a crowbar. An ore spreader simplifies the loading of alumina into the pots, and a pin pusher which inserts contact pins into the electrodes can be operated by one man instead of two. Another innovation is a paste delivery wagon which more efficiently conveys carbon material for the anodes.

The foundry is believed to be the most advanced facility of its kind in use by the American automotive industry. Castings are produced by three methods—die-casting, conventional permanent-mold casting, and low-pressure, permanent-mold casting—a method comparatively new to the foundry industry in the United States.

Parts which are die-cast include flywheel housings, crankcase covers, idler brackets, oil-cooler adapters, and stators and clutch housings for the automatic transmission. Permanent-mold casting operations are confined to pistons and camshaft gears. The new low-pressure, permanent-mold method is used for the two halves of the crankcases, gear housings, oil-filter adapters, and cylinder heads. The last-mentioned part is one of the most intricate aluminum castings made anywhere. Since the start of volume production, Chevrolet-Massena has produced more than 3,600,000 castings containing more than 24,800,000 pounds of aluminum.

As soon as the hot-metal truck reaches the plant, a sample is taken from each of the two ladles. The laboratory receives the samples through a pneumatic tube. Within ten minutes results have been evaluated and disposition made. Only then is the metal poured into the foundry's

holding furnaces. In the meantime, the metal is being fluxed with chlorine to remove any gases present.

The new low-pressure process is an intermediate one between die-casting and conventional permanent-mold casting. Pressure is used to force the molten metal into the mold cavity, but the pressure is considerably less than normally used in die-casting. Air pressure up to 10 psi is used to push, or flow, the aluminum into the mold cavity in a relatively smooth and slow manner without turbulence. The mold cavity is mounted above a holding furnace and receives metal directly from a tube, or stalk, immersed in the molten aluminum.

Pressurized air in the casting machine furnace is regulated to force the metal up the stalk into the mold cavity. The slow flow of metal creates a natural temperature gradient in the mold cavity and promotes directional solidification back to the source of the molten metal. The air pressure assists in this feeding of molten metal until the casting has solidified. After solidification, the air pressure is released, the mold opened, and the casting lifted and ejected.

Advantages claimed for the low-pressure

process are:

 High density structure—Castings are of high density and can be produced virtually free from

porosity and shrinkage.

2. High yield—Large gates (entries) and risers (overflows) are eliminated, saving cost of removing and remelting them. Often, conventional permanent-mold castings require gates and risers totaling half their finished weight to assure adequate filling of the product.

3. High productivity-Automatic fill and hydraulically actuated molds permit one man to

operate more than one machine.

4. Low equipment costs—Initial costs are lower than for die-casting, and about equal to equipment for permanent-mold casting.

5. Clean castings—Due to the sealed furnace and under-pouring of metal, castings made by the low-pressure method are relatively free of

oxides.

The low-pressure equipment being used at Chevrolet-Massena was designed specifically for that plant by the General Motors Process Development Section at the GM Technical Center near Detroit. Castings are shipped to Chevrolet's Tonawanda, N. Y., engine plant, where they are machined and assembled with other components.

PORTABLE AIR DRILLS SAVE HEAVY HANDLING

Machine tool builder uses a novel arrangement of drills and fixtures in setup that mounts equipment for precision machining operations directly on the work

IN BUILDING modern turret lathes the use of integral bed and gear-box castings increases rigidity and accuracy of the resulting machine tool. But the penalty of using this design is that many areas on the face of the headstock are inaccessible to radial drills. Also the weight of the one-piece castings is great and so distributed as to make them awkward to position. About fifty holes must be drilled in the headstock face and the end of the bed, some at odd angles.

Warner & Swasey Co., Cleveland, Ohio, builder of the turret lathes, has solved the problem of accessibility and handling at a single stroke with a novel application of air-powered drills. The drills are carried to the work, which never moves from one position on the shop floor, Fig. 1.

The operator can easily lift the drilling units

and position them accurately in special fixtures equipped with simple bayonet mountings. Positioning fixtures for the drill units are located with reference to previously machined surfaces, such as bores, and rigidly support the air drills for all 90-degree-to-surface and angular holes. The drill units are various sizes of "Airfeedrills" supplied by the Grand Haven (Keller) division of Gardner-Denver Co.

Several holes can be drilled simultaneously, using multiple or separate fixtures as needed. Each individual air drill unit is permanently tooled with one size of drill and hole depth. After a hole has been completed, the drilling unit can be moved to other fixtures and mountings to drill holes of similar size and depth wherever required, Fig. 2. This system is faster and more



Fig. 1. Pertable air drills cut about fifty mounting and lubrication holes in big one-piece head and bed castings for Warner & Swasey turret lathes. The entire job is completed while werk-piece remains stationary on production floor.



Fig. 2. Close-up of portable air drilling units in position on a headstock. Air drills are rigidly supported by special fixtures equipped with simple bayonet mounting bushings. The drills are quickly moved to other mountings and fixtures where similar hole size and depth are needed.

economical than repeatedly stopping to change drills and to reset depth limits to accommodate different size holes, or using manual drilling equipment. Once started, each Gardner-Denver drill cuts a given hole without further attention from the operator, stopping automatically upon reaching the preset depth.

An important advantage of the air drills is that they are sufficiently compact to allow operation

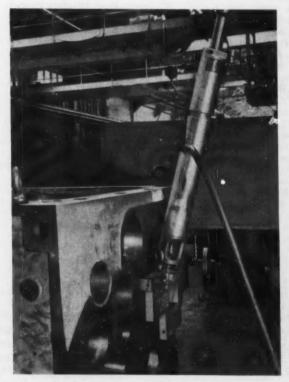


Fig. 3. Drilling outward from inside a bearing bore, this air drill cuts a 5/8-inch angular lubrication hole in the headstock portion of a frame casting.

in awkward places; including several off-square drilling operations on 5/8-inch headstock lubrication holes, Fig. 3. These holes, in fact, are drilled outward on an angle from inside bearing bores—unfeasible to approach using any other method except hand drilling.

Tool and fixture cost of the air drills versus equivalent cost on a radial drill is about 1 to 1 according to Warner & Swasey. A radial drill is somewhat faster, but considering the easier setup and sharply reduced handling time with the air units, speed during the actual drilling operation is secondary. There also is less chance for human error using the air drill and fixture method.

The largest holes air-drilled by Warner & Swasey are 31/32 inch by about 2 1/2 inches deep. The drill units weigh between 10 and 40 pounds, hence they are manually portable.

Maintenance of the "Airfeedrills" is carried out at six-month intervals, when they are given a general overhaul. This consists of simply disassembling, cleaning, greasing, repacking, and reassembling. Drill breakage is nil, a result of the comparatively low speeds at which the air spindles are operated.

The company has not yet explored the full potential of air drills in production applications. It is conceivable that a radial drill and air drill setup could be combined for drilling from several directions at once. A potential asset of such a system would be that while the radial drill was running, the operator could also plug in several air drills to perform unattended.

Special Steels Developed for Minus 300-Degree F. Temperatures

Arctic defense systems, space probes, and some phases of modern industry all have need for materials that will not fail in super-cold temperatures. Steels have been developed that are among the few materials with high strength at temperatures in the vicinity of minus 300 degrees F.

Recently reported installations include the foundation members for military and radar units in the arctic, where temperatures frequently fall to 80 degrees below zero.

To withstand still greater cold, the Air Force recently ordered cryogenic steel in a test device for simulating the rapid changes encountered by aircraft zooming from sea level to about 90,000 feet. Strength at minus 150 degrees is required. Liquid oxygen, which must be kept at below minus 298 degrees F., is a major fuel in rocketry, and is now being stored successfully in steel tanks.

109 Engineering Students Win Machine Design Awards

The following 1960 graduates have been named by their respective engineering colleges as the recipients of Machinery's Achievement Award for outstanding excellence in machine design. The award, a copy of Machinery's Handbook and its companion volume, "The Use of Handbook Tables and Formulas," together with a one-year's subscription to Machinery, has been made

available for the fifth year by The Industrial Press as a stimulus to machine design scholastic excellence.

One hundred and seven colleges participated in 1960, as compared with sixty-eight in 1959 and sixty-three in 1958. Forty-one states and the District of Columbia were represented in this year's awards,

Antioch College Bradley University Carnegie Institute of Technology Case Institute of Technology City College Colorado School of Mines Colorado State University Cooper Union Cornell University Drexel Institute of Technology **Duke University** Fenn College Georgia Institute of Technology Harvard University Howard University Illinois Institute of Technology Iowa State College Johns Hopkins University Kansas State University Lafayette College Lehigh University Louisiana Polytechnic Institute Manhattan College Marquette University Massachusetts Institute of Technology Michigan College of Mining and Technology Michigan State University Mississippi State University Missouri School of Mines and Metallurgy Montana State College Newark College of Engineering New Mexico College of A&M Arts New York University North Dakota State College Northeastern University Northwestern University Ohio Northern University Ohio University Oklahoma State University Pennsylvania State University Polytechnic Institute of Brooklyn **Pratt Institute** Princeton University Purdue University Rensselaer Polytechnic Institute Rice Institute Rose Polytechnic Institute Rutgers University South Dakota School of Mines Southern Methodist University Stanford University State College of Washington Stevens Institute of Technology Swarthmore College

WILLIAM GODDARD RICHARD D. ROCKE LEONARD I, ORTENBERG WILLIAM E. TOSKO GORDON D. MOSKOWITZ JOHN R. SMITH CLAYTON L. ENIX DAVID SCHWARTZ LEONARD H. COPELAND JOHN G. MARKS TODD S. BRADFIELD RICHARD R. REIMER IOHN M. HORNE STERLING DOW CLARENCE E. LONDON JAMES R. HUNTER THEODORE OKIISHI STUART L. HANLEIN LEO W. SCULLY LEWIS N. POWELL JOSEPH M. SMITH, JR. KERRY E. STOKES JOHN P. GARDINER BRIAN J. BEDNARSKI HARRY K. CLARK II JAMES E. SORENSON GERALD E. MOLTER LYNN D. RUSSELL KENT W. CHRISTIANSEN LARRY P. COOPER RONALD C. KNOBEL RICHARD L. BERLEMANN VINCENT I. SANSEVERO DENNIS PROTHERO RICHARD L. MUISE JOHN L. KEREKES DERRILL J. BODNAR DAVID L. ECK CHARLES D. CLINE ROBERT M. VIJUK FREDERICK SCHMIDT ROBERT B. STEGER ROBERT H. SWOPE DAVID O. HARROLD WILLIAM J. ZIMMER BRUCE I. HENDRICKSON EDMUND JAMES NEAL F. SHEPARD, JR. NILS SNEKKEVIK WILLIAM D. TRIBBLE ALAN R. PITKANEN WAYNE L. FUNK ROBERT P. FORSLUND PETER J. KROON ROBERT J. BRISLIN JOHN R. SHANEBROOK

Kinsman, Ohio Peoria, Ill. Pittsburgh, Pa. Cleveland, Ohio Bronx, N.Y. Stratton, Colo. Fort Collins, Colo. Brooklyn, N.Y. Ithaca, N.Y. Philadelphia, Pa. Durham, N.C. Cleveland, Ohio Huntington, W.Va. Cambridge, Mass. Washington, D.C. Villa Park, Ill. Honolulu, Hawaii Baltimore, Md. Wichita, Kan. Easton, Pa. West Atlantic City, N.J. Shreveport, La. Hawthorne, N.Y. Milwaukee, Wis. Boston, Mass Houghton, Mich. Coloma, Mich. Pontotoc, Miss. Rolla, Mo. Willow Creek, Mont. Lincoln Park, N.J. University Park, N.M. White Plains, N.Y. Fargo, N.D. Roxbury, Mass. Wilmette, Ill. Oak Harbor, Ohio Athens, Ohio Cushing, Okla. State College, Pa. Fairlawn, N.J. Laurelton, N.Y. Chevy Chase, Md. Fort Wayne, Ind. Glen Cove, N.Y. Port Arthur, Tex. Terre Haute, Ind. Tenafly, N.J. Rapid City, S.D. Dallas, Tex. Lynwood, Calif. Sunnyside, Wash. Indianapolis, Ind. Swarthmore, Pa. Syracuse, N.Y. Syracuse, N.Y.

Syracuse University

Texas Technological College **Tufts University** Tulane University Union College University of Akron University of Alabama University of Arkansas University of Buffalo University of California University of Cincinnati University of Colorado University of Connecticut University of Delaware University of Houston University of Idaho University of Illinois University of Kansas University of Kentucky University of Maine University of Maryland University of Massachusetts University of Michigan University of Minnesota University of Missouri University of Nebraska University of Nevada University of New Mexico University of North Dakota University of Notre Dame University of Oklahoma University of Pennsylvania University of Rhode Island University of Rochester University of South Carolina University of Southern California University of Tennessee University of Texas University of Utah University of Vermont University of Virginia University of Wisconsin University of Wyoming Valparaiso University Vanderbilt University Villanova University Virginia Polytechnic Institute Washington University Wayne State University Wentworth Institute

West Virginia University Worcester Polytechnic Institute Yale University LEVERN A. REIS ROBERT D. MORAN DANIEL B. HANKINS, IR. STANLEY COULTER BRUCE R. HEUPEL ROGER P. WHITFIELD VERNIE E. HEIRD WILLIAM J. BATES DAVID R. HORNBAKER NORMAN F. GREEN FRANK J. JAMNICK GEORGE WEIMANN JAMES M. EVANS JACK T. MCKENNA GERALD J. ROHWEIN DEAN KUEHL VERNON E. ALLEY GORDON K. SAPP RICHARD J. BROCKWAY RICHARD STRUCKO EDWARD P. APRIL IAMES M. DEIMEN JEROME R. BICKFORD LEWIS L. MCALLISTER ARNOLD A. WIEBOLD JACK A. MYERS FLOYD E. LUNDY, JR. RAY J. HEMMING JOSEPH F. MCBRIDE WALTER W. ROBERTSON WILLIAM A. SEGRAVES RICHARD M. SALTZMAN JAMES C. FOOTE, JR. CLAUDE A. BARRETT DON L. BROWN JAMES B. GLASS STUART D. KERSHNER GORDON R. LOWHAM DONALD C. GRAY ERNEST R. LEDUKE DAVID H. EBER CLEN SHELTON JUSTUS A. W. HORSTMAN PAUL E. YOUNG JAMES P. O'LEARY ALAN B. MINTHORNE DAVID W. MOORE BRUCE L. ETTINGER VERNE C. SMITH DONALD T. SMITH JOHN L. WHITE ROBERT A. CHECHILE FREDERICK A. REKER

Lubbock, Tex. Waltham, Mass. New Orleans, La. Homer, N.Y. Akron, Ohio Fairfield, Ala. Pine Bluff, Ark. Niagara Falls, N.Y. Oakland, Calif. Canton, Ohio Boulder, Colo. Hartford, Conn. Wilmington, Del. Houston, Tex. Moscow, Idaho Champaign, Ill. Merriam, Kan. Lexington, Ky. Orono, Me. Baltimore, Md. Leeds, Mass. Pinckney, Mich. Minneapolis, Minn. New Franklin, Mo. Madison, Neb. San Rafael, Calif. Albuquerque, N.M. Rolla, N.D. St. Louis, Mich. Norman, Okla. Philadelphia, Pa. Providence, R.I. York, N.Y. Heath Springs, S.C. Huntington Park, Calif. Knoxville, Tenn. Austin, Tex. China Lake, Calif. South Burlington, Vt. Charlottesville, Va. Racine, Wis. Laramie, Wyo. Dorsey, Ill. University City, Mo. Harrisburg, Pa. lacksonville, Fla. Florissant, Mo. Detroit, Mich. Boston, Mass. Malden, Mass. Weston, W.Va. Springfield, Mass. Scarsdale, N.Y.

Researchers Tackle Problems of Wear and Friction

Fundamental research aimed at developing a metal-wear science has united ten nationally known industrial firms in an extensive program now under way at the Armour Research Foundation of the Illinois Institute of Technology. Wear and friction are probably the least understood and the most difficult engineering properties of metals to evaluate. A study of them, it is felt, would save industry millions of dollars annually.

ARF's scientific team is made up of researchers

in metals, mechanics, physics, and chemistry. The primary purpose of the three-year, \$300,000 research program is to inquire into the complexities surrounding wear-friction phenomena. Sponsors of research are American Steel Foundries, Bethlehem Steel Co., Briggs & Stratton Corporation, Clevite Corporation, Dow Chemical Co., Inland Steel Co., International Harvester Co., International Nickel Co., Socony-Mobil Oil Co., and United States Steel Corporation.

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts, and

Rotary Indexing Surface Grinder with Orbiting Wheel-Spindle

A new type of rotary indexing surface grinder on which the work is held in a stationary fixture under a wheel-spindle that orbits as it rotates is being manufactured by the Mattison Machine Works, Rockford, Ill. This machine, Fig. 1, has been developed to reduce the cost of grinding parts to close flatness tolerances. It is being used in its first commercial application, Fig. 2, to grind pump piston cover assemblies to a flatness tolerance of 0.0005 inch at a production rate of 140 per hour. Stock is removed to a depth of 0.004 inch.

The principle applied in generating a flat surface on this orbiting or planetary head machine produces results that are similar to those obtained on a conventional vertical-spindle rotary surface grinder. Instead of spinning the work under a stationary spindle, however, the work remains fixed and the wheel axis revolves around its center point as shown diagrammatically in Fig. 3.

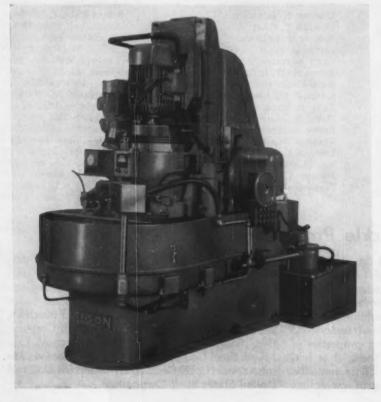
The new method of generating flat surfaces has three economic advantages; (1) Holding the workpiece stationary in its fixture keeps it accurately oriented. Thus, it is easy to load, transfer, and unload the part without danger of faulty location of the work. This makes the process specially adapted for grinding work from the rough on transfer type machines. (2) Equipment costs are reduced because fewer mechanical parts are needed to revolve the spindle than to provide separate drives for spinning the work. (3) Continuous cutting, with index type work-table, increases machine utilization and permits high production rates.

Another advantage is realized in grinding thin parts which spring under a heavy cut. While operating, the planetary face type wheel covers the work surface area evenly. This reduces pressures on any one section-practically to zero as the machine sparks out. Planetary head machines, such as shown in Figs. 1 and 2, are designed to use self-dressing wheels to advantage. Once the wheel has been trued during initial setup, wear takes place evenly so that work of practically perfect flatness results. A post-process gaging system actuates an independent automatic feed for controlling size. Conventional push-button or manual operation of down feed actuates rotation of the feed-screw.

By setting zero on the air gage to the mean tolerance, then setting the automatic feed to operate in increments of approximately onehalf the tolerance limit, the machine can be set up to maintain high accuracy on an uninterrupted basis.

In the grinding job illustrated in Fig. 2, the work is held lightly by almost zero clamping pressure, which is applied by cams. This prevents distortion while holding the parts snugly against stops. Grinding pressure forces the parts down against locating surfaces on

Fig. 1. Mattison 24A-P vertical-spindle, single-pass surface grinder equipped with planetary head and index type table for machining extremely flat surfaces at high production rates



IN

SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

the fixtures. Thus, loading and unloading are easily accomplished while working at high production rates. Fixtures or magnetic chucks may be used on this type of machine, depending on the shape of the work.

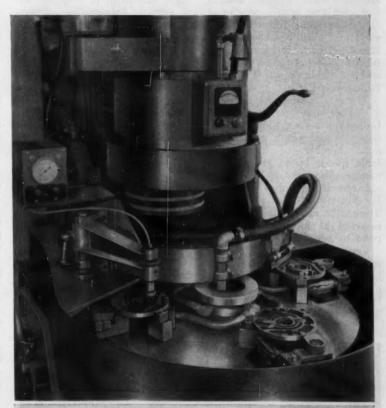
The planetary wheel-head is designed to house either one or two spindles, depending on production requirements. An auxiliary motor drives the spindle assembly through V-belts, while the main wheel-head motor powers the spindle through a timing belt, which revolves radially as it drives.

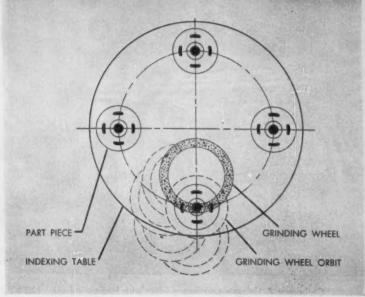
The planetary head principle is especially well suited to high-production surface grinding on conventional type vertical-spindle machines. It also permits combinations of grinding with drilling, boring, reaming, and tapping on such parts as electric motor frames, valve bodies, transmission housings, and engine blocks. When the work is held in stationary fixtures or chucks, it is oriented for other stations in an index type, aroundthe-table, or transfer type machine requiring either vertical, horizontal, or angular mounting of heads. Mattison is now building both standard machines (such as the one illustrated here) and special automatic equipment with either single- or double-spindle planetary heads.

Circle 565 on Readers' Service Card

Fig. 2. (Above) Parts are ground to a flatness tolerance of 0.0005 inch at a production rate of 140 per hour on this recently developed machine. Post-process gage probe (left) actuates automatic feed to compensate for wheel wear

Fig. 3. Diagram showing path of the wheel as the planetary head spindle of machine shown in Figs. 1 and 2 orbits around the center of the workpiece at 60 rpm, about the speed at which work would rotate on a conventional vertical-spindle machine





Surface Grinder with Hydraulic Feed

Micro-inch finish at production speeds is obtainable with a fully hydraulic feed surface grinder introduced by the Gallmeyer & Livingston Co., Grand Rapids, Mich. This machine (No. 206) is built around a solid one-piece column and base that assures permanent alignment between vertical-head ways and cross-travel ways. The amount of cross-feed is controlled from a panel on the saddle front and is variable up to 1/4 inch per table reversal.

The machine is equipped with a Vickers vane type pump and a Gallmeyer & Livingston-designed control valve which give an infinite number of longitudinal table speeds up to 110 feet per minute. Also provided is a variable-speed continuous cross-feed for dressing or quick positioning. The saddle may be automatically reversed at any predetermined point by adjustable dogs.

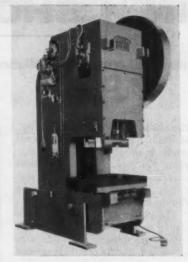
Vertical movement of the wheel-head is accomplished by a large (outer) handwheel and/or a small (inner) one, conveniently located on the head of the grinder. The large handwheel, used for

coarse vertical adjustment and graduated in widely spaced thousandths, provides a movement of 0.012 inch per turn.

The severe service demanded by the use of diamond wheels is taken care of on this machine by a rugged, four-bearing, grease-sealed spindle which requires no lubrication for the life of the bearings. The machine is regularly equipped with an 8-inch grinding wheel which provides for a capacity of 13 inches under the wheel and a vertical movement of 14 inches. The weight of the machine without accessories is 3300 pounds.

Welded-Frame Open-Back Inclinable Press

Advanced styling and reduced maintenance costs obtained through the use of steel plate highlight a new line of welded-frame open-back inclinable presses brought out by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. This line of presses covers a capacity range of from



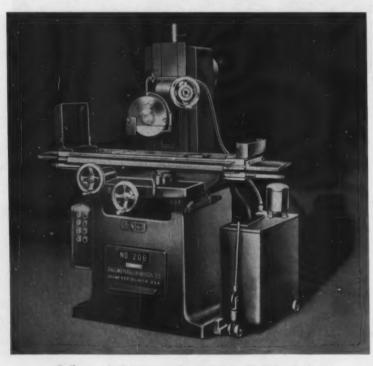
Cleveland 150-ton open-back inclinable press

75 to 200 tons. The streamlined styling of the welded frame and the box type slides provide for greater production accuracy and more dependable barrel type slide adjustment. Maintenance costs are reduced by the new design, which combines the advantages of welding and the use of steel plate to achieve a stronger structural frame.

Designed for a great variety of sheet-metal production operations, these presses permit free access of material from front to back and right to left. In addition, they can be inclined in three different positions to accommodate various types of dies and at the same time make use of gravity feed and discharge in automated production lines. Because the basic design is flexible, variations can be obtained by using a flanged, as opposed to a plain, slide, giving a larger slide area, or by modifying dimensions such as length of stroke and slide adjustment. All the presses in this line are adapted for punching, shearing, perforating, forming, and bending sheet metal.

Available with either flywheel or geared drive, these presses have an arrangement of electrical controls that will give the operator instant command of every press function. All are equipped with Cleveland's patented electrically controlled, air-operated friction clutch.

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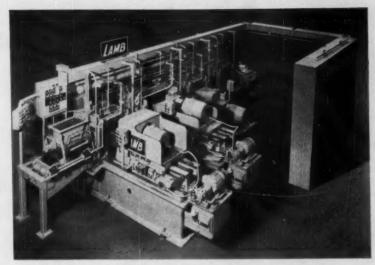
Gallmeyer & Livingston surface grinder with hydraulic feed

Hopper-Fed Six-Station Transfer Machine

A six-station, in-line transfer machine built by F. Jos. Lamb Co., Detroit, Mich., uses a hopper to meter and feed adjustable sleeves for steering tie-rods to the transfer mechanism. There are four machining stations plus loading and unloading stations. Operations performed are: core drill both ends, mill slots in both ends, tap one end, and tap opposite end. The production rate is 625 pieces per hour at 100 per cent efficiency.

The hopper loads four parts at a time. Each part is carried in a pair of U-brackets that are mounted on the heavy roller chain conveyor. The chain is driven by a Geneva indexing mechanism that utilizes a cam-actuated limit switch for timing or controlling the indexing and braking functions. Guide rails maintain side-to-side position, and spring tension bars prevent parts from jumping out of the transfer brackets. At each work station the parts are lifted into Vblocks and hydraulically clamped for positive positioning.

Work is performed wet. Machine fixtures and main bases are well drafted for good coolant and chip disposal to central systems. Lamb standard slide and tapping units perform all machining func-



Six-station hopper-fed transfer machine for processing automotive part, built by the F. Jos. Lamb Co.

tions. Lubrication is completely automatic including oil mists to heads and conveyor chain. Electrical interlocks assure proper se-

quencing. All electrical and hydraulic components conform to JIC standards.

Circle 567 on Readers' Service Card

G&L Vertical Boring Mill with Removable Table

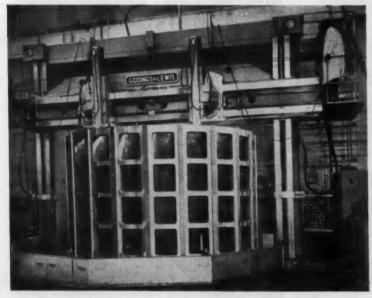
Work-pieces in a wide range of sizes can be machined efficiently on a 100-hp vertical boring mill with a 20-foot swing, built by Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., for the Verson Allsteel Press Co., Chicago, Ill. The machine is equipped

with a 12-foot diameter table over which is fitted a 16-foot table for machining large work-pieces. The larger table can be removed so that the operator can more easily handle smaller work-pieces, permitting higher machining speeds.

Table loads up to 75 tons can be accommodated with an ample safety factor. Vertical thrust load is carried by a double antifriction bearing table track and a double preloaded tapered Timken bearing at the center of the table. The center bearing also takes all radial thrust. The table drive speed range is 0.26 to 22.5 rpm. Shifting is accomplished by hydraulic pressure which is controlled electrically from the pendant station. Infinitely variable table speeds in a ratio of 21.8 to 1 ratio motor speed range. two speed ranges. Constant horsepower is available to the table over a 3 to 1 ratio range and constant torque is available beyond the 3 to 1 ratio range and through 21.8 to 1 ratio motor speed range.

Control of all machine functions is provided in a pendant station. In addition, push-button stations are located at each end of the rail for starting and stopping the table.

Circle 568 on Readers' Service Card



Vertical boring mill with removable table built by the Giddings & Lewis Machine Tool Co.

Bliss-Derota Press

A combination multiple-slide and transfer press which is said to cut conventional tooling costs by as much as one-half is being marketed by the E. W. Bliss Co., Canton, Ohio. This Bliss-Derota press is designed to offer outstanding economies to producers of small parts in job-lot quantities and is available in capacities of 3 and 9 tons. It can blank, pierce, form, and bend in one single continuous operation, at speeds up to 100 strokes per minute.

It is claimed that tooling costs can be cut in half because the tooling is divided into separate units, making it far less costly than equivalent progressive die tooling for a single-slide press. This feature also makes cost-cutting possible on short-run operations. Another advantage of this press is its capacity for extremely accurate, distortion-free primary blanking work.

The tolerances on finished parts are not dependent on accurate feeding of the strip since the blank is separated from the strip at the first station and positively held for subsequent operations. As a result, there is no bending or twisting of the stock such as sometimes occurs in conventional progressive die operations.

Since all tool-holders are individually adjustable for height, changes to new parts are easily made. Each stage of the press is completely separate so that each

tool, guide, and slide is easily accessible without disturbing the settings of adjacent stations. A combined roll-straightener and feed unit is also available, which increases the versatility of the press by allowing the strip to be fed laterally. With this unit attached, maximum feed of stroke for the 3-ton press is 3 inches, and for the 9-ton model, 5 inches.

Circle 569 on Readers' Service Card

Bliss Inspirator Burners

The E. W. Bliss Co., Canton, Ohio, announces a redesigned line of inspirator burners known as the HP 220 series. These burners are suited for applications in any plant where high-pressure gas (5 psi or more) is used. These include the ceramics field, periodic kilns, tunnel kilns, drying applications, foundries, core ovens, ladle heaters, and annealing and heat-treating furnaces.

This improved burner uses atmospheric air to mix with the fuel and may attain a fuel savings of 30 per cent, depending upon the application. It is 16 inches long by 5 inches in diameter, weighs 15 3/4 pounds, and has a range or from 20,000 to 1,500,000 Btu. The only attachment necessary is a gas line.

The burner is of the nozzlemixing, high-pressure design with pulsation type combustion. The flame rises instantly to full heat and burns with a pulsating action. The extremely high efficiency and high temperature attained by Bliss pulsation type burners are said to result from the fact that they actually explode the fuel.

Circle 570 on Readers' Service Card
(This section continued on page 186)



Combination multiple-slide and transfer press



Bliss burner that attains full heat temperature instantly



PRECISION MEASURING TOOLS — No. C359A Satin-Chrome Universal Bevet Protractor, No. C493B Satin-Chrome Protractor and Depth Gage • No. C183 Satin-Chrome Steel Protractor illustrated above.

who wouldn't work better with Starrett tools like these?

Starrett developed SATIN-CHROME Finish and brought glare-free, easy reading to precision measuring tools. This glare-free, hard chrome finish, pioneered by Starrett, also resists stains, corrosion and wear . . . helps protect the precision that Starrett builds into every tool.

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World's Greatest Toolmakers





PRECISION GROUND DIE AND FLAT STOCK
HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES

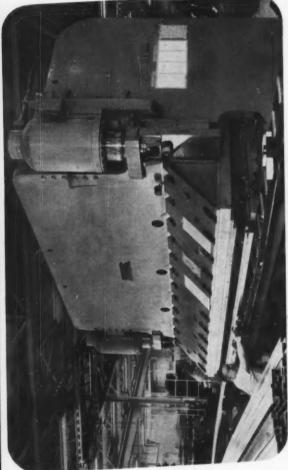


VISIT BOOTHS 150-152, PRODUCTION ENGINEERING SHOW

15 years engineering and millions of dollars invested * to perfect the world's finest brake...today's BRAKE PACIFIC HYDRAULIC PRESS

brakes in operation Over 9 out of every 10 hydraulic press today are PACIFIC providing ...

- More dependability
- Freedom of maintenance and leakage
- Simpler electric controls
- Simpler hydraulic control
- More accuracy in level control
- More accuracy in air bending
- More operating convenience
- Greater visability
- More rigidity in cylinder construction
- Shock-free hydraulic system suitable for punching



punch life and eliminate costly downtime from periodic die replacement of 672 separate dies. hydraulic breakthrough softens the punching action on the dies to greatly increase individual Indiana. This rigidity permits 40 ft. long rub rails to be punched progressively with 70 holes on 2" centers over 12 ft. length on the front of the die as shown in the above photo. Cushioned 672 HOLES PUNCHED IN A SINGLE HIT! Unique upper ram guides and extra rigidity of platens of PACIFIC hydraulic press brake enable the punching of 672 holes in a single hit over a 45" wide by 14 ft. long side panel at Brown Trailer Division, Michigan City,

PRESSES ACIFIC

DISTRIBUTORS: ALBUQUERQUE, N. M.; DENVER, COLO.—R. E. Duboc Associates - ARIZONA; IOS ANGELES AND BURLINGAME, CALIF; NEVADA—Tennquist Machinery Company - ATLANTA CITY and ST. LOUIS, GA. A. R. Carlon Machinery Company - CHICAGO, ILL.—I. G. Evans & Company - CHICAGO, ILL.—I. G. Evans & Company - CHICAGO, ILL.—I. G. Evans & Company - DALIAS, TEXAS—Machinery Tool Assistant Machinery Company - DALIAS, TEXAS—Machinery Tool Assistant Machinery Company - DALIAS, TEXAS—Machinery Company - DALIAS, TEXAS—Machinery Company - CHICAGO, ILL.—I. Green Ach. C. - MOUNT VERNON, N. Y.—Van Dyte-Churchill Co. - MILWAUKEE, WIS, MINNEAPOLIS, MIN PACIFIC INDUSTRIAL MFG. CO., OAKLAND, CALIF. . PACIFIC PRESS AND SHEAR CORP., MT. CARMEL, ILL.

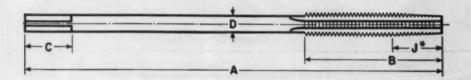
ENABLED PACIFIC THIS INVESTMENT TO INTRODUCE:

- cylinders within .003" (1947) · Cushioned punching (1949) Tape control to synchronize
- · Precision depth control to repeat accuracy within .001" (1951)
- · Manual turret stroke controls for progressive bending (1952)
- · Tandem operation of press brakes eliminate reverse bends (1952) Selective anti-whip speeds to
- for forming pieces 40 ft. or longer · Tonnage control to protect light
- · Multiple hydraulic cushion cylinders dies in heavy press (1953)
 - · Overhead integral power unit for for deep drawing (1954)
- · Cylinder ram guides for increased increased accuracy (1955)
 - rigidity (1956)
- heavy plate on press brake (1958) · Shearing attachment for shearing
 - · Pipeless stacking of valves to eliminate pipe breakage and leakage (1959)
- eliminate cause of leakage (1959) · Shockless hydraulic valving to

AMERICAN STANDARD CUT AND GROUND THREAD TAPS-17

Nut Taps

High-Speed Steel-Ground Thread



General Dimensions

Diameter of Tap	Threads per Inch High-Speed Steel				Dimensions				
			Number of Flutes	Length Overall	Length of Thread (B)		Length	Diameter	Size
	NC UNC	NF UNF		Verali	NC UNC	NF UNF	Square	Shank D	Square
1/4 1/4 1/4 1/4 1/4 1/4 1/4 1/4 1/4 1/4	20 18 16 14 13	28 24 24 20 20	4 4 4 4 4	5 5 % 6 6 % 7	1 % 1 13/46 2 % 2 % 2 %	1 1/4 1 1/4 1 1/4 1 1/4	*/** */* */* */*	0.185 0.240 0.294 0.345 0.400	0.139 0.180 0.220 0.259 0.300

All dimensions are given in inches.

These taps are furnished in H3 limit only.

The chamfer "J" is made 1/2 to 3/4 the thread length "B".

Ground thread taps have internal center in thread end.

Toler ances

Element		Range	Direction	Tolerance Ground Thread	
Length Overall	(A)	1/4 to 1/2 incl,	plus or minus plus or minus plus or minus minus minus	1/16	
Length of Thread	(B)	1/4 to 1/2 incl,		1/16	
Length of Square	(C)	1/4 to 1/2 incl,		1/32	
Diameter of Shank	(D)	1/4 to 1/2 incl,		0.005	
Size of Square	(E)	1/4 to 1/2 incl,		0.004	

All dimensions are given in inches.

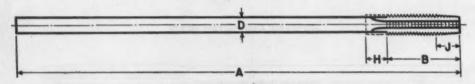
For eccentricity tolerances of tap elements, see table in MACHINERY'S Data Sheet published in February, 1980, page 186.

Extracted from American Standard Tape-Cut and Ground Threads (ASA B5.4-1959), with the permission the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

AMERICAN STANDARD CUT AND GROUND THREAD TAPS-18

Straight Shank Tapper Taps

(Fractional Sizes)
Carbon Steel—Cut Thread
High-Speed Steel—Ground Thread



						Gen	ieral Dim	ensions				
Diameter of Tap Carl	Threads per Inch			Nume	Dimensions				Number of			
	Carbon Steel		High-Speed Steel		ber	Length Over-	Length of Thread (B)		Diam- eter	Length of	Threads Chamfered J	
	NC UNC	NF UNF	NC UNC	NF		all A	NC UNC	NF UNF	of Shank D	Nut Guide H	NC UNC	NF UNF
3/4	20	28	20	28	3	12	1 1/4	1	0.185	1/4	11-12	15-17
8/4	18	24	18	24	3	12	1 %	1 1/4	0.240	3/4	11-12	15-17
3/4	16	24	16	24	3	12	1 %	1 3/4	0.294	3/4	11-12	15-17
% % % % % % % % % % % % % % % % % % %	14	20	14	20	3	12	1 13/4	1 %	0.345	1/40	11-12	15-17
1/2	13	20	13	20	3	12	1 %	1 %	0.400	1/2	11-12	15-17
%	12	18			4	15	2 %	1 %	0.450	%	11-12	15-17
3/4	11	- 18			4	15	2 %	111/4	0.503	3/4	11-12	15-17
3/4	10	16	1		4	15	2 1/4	1 %	0.616	3/4	11-12	15-17
1/4	9	14			4	15	2 3/4	1 %	0.727	3/4	11-12	15-17
1	8	12,14			4	15	3 %	2 %	0.834	1	11-12	15-17
1 %	7	12			4	15	3 1/2	2 %	0.933	1 %	11-12	15-1
1 1/4	7	12			4	15	3 1/4	2 %	1.058	1 %	11-12	15-1
1 %	6	12			4	15	4	2 %	1.153	1 %	11-12	15-1
1 %	6	12		1	4	15	4	2 %	1,278	1 %	11-12	15-17

All dimensions are given in inches.

*1"-14 NS is American special and furnished to same dimensions as 1-12 NF.
These taps are furnished with plain round shanks.
Ground Thread taps are standard in H3 limit only.

When so specified, tapper taps will be furnished with any of the following standard shanks,

Squared Acme Type (*C") National Interchangeable Ring Lock
All taps up to 13/32", inclusive, have external center on thread end; sizes 7/16" and larger have internal cen-

ter in thread end.

A nut guide "HP", approximately equal in diameter to the basic minor diameter, may be furnished on taps having threads NF-UNF and finer.

Tolerances

+ 12			Tolerance		
Element	Range	Direction	Cut Thread	Ground Thread	
Length Overall (A)	¼ to 1 incl. 1 % to 1 % incl.	Plus or Minus Plus or Minus	3/4	*	
Length of Thread (B)	% to % incl. % to 1 % incl.	Plus or Minus Plus or Minus	1/18 3/82	2/16	
Diameter of Shank (D)	% to % incl. % to 1 incl. 1 % to 1 % incl.	Minus Minus Minus	0.005 0.006 0.008	0.005	

All dimensions are given in inches.

For eccentricity tolerances of tap elements, see table in MACHINERY'S Data Sheet published in February, 1980, page 186.

Extracted from American Standard Taps—Cut and Ground Threads (ASA B5.4-1959), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

WEAR RESISTANT THOMSON

60 Ca

AVOID the HIGH COST
and difficulty of fabricating
long, hard & straight
parts by
conventional
methods!

nardened and ground

SHAFTS, ROLLS, GUIDE RODS and other long-round parts
ELIMINATE WEAR and REDUCE COST

of over 15 years of experimental work and production experience with hardened and ground shafts which are a requirement for BALL BUSHINGS, the Linear Ball Bearing manufactured by Thomson Industries, Inc.

The special techniques and equipment that have been developed enable high production rates and low handling costs. This permits big savings over conventional methods which are plagued with erratic warpage, straightening and resultant grinding problems. Finished 60 Case parts frequently cost less than the scrap losses that result from conventional methods.

60 Case material has a surface hardness close to 60 on the Rockwell C scale which is essential to resist wear.

Long lengths of material ranging in diameter from ¼" to 4" are stocked to enable prompt shipment of 60 Case parts, with or without special machining. Write for literature and name of your local representative.

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ADVANTAGES of 60 Case

- COST REDUCTION
- . HARD BEARING SURFACE
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- . UNIFORM HIGH QUALITY

TYPICAL 60 Case PARTS

GUIDE RODS • SHAFTING • ROLLS • TRAVERSE RAILS
PISTON RODS • ARBORS • LEADER PINS • TIE RODS
KING PINS • AXLES • CONTROL RODS • GUIDE POSTS
MANDRELS • BEARING ROLLERS • SPINDLES

THOMSON INDUSTRIES

Inc.
Dept. C-9 Manhasset, New York

PARTS HARDENED to 60 C...

increase life ... reduce cost!



Sheffield ultrasonic tool for machining hard and brittle materials

Ultrasonic Equipment for Precise Machining of Hard and Brittle Materials

An ultrasonic tool for precise machining operations in hard and brittle materials, including dicing of germanium and silicon wafers and other semiconductor materials, has been developed by the Sheffield Corporation, Dayton, Ohio, subsidiary of the Bendix Corporation.

This compact, space-saving machine is designed to enable small companies and research or development laboratories to obtain a low-cost ultrasonic machine tool suitable for low-production requirements but which has the capacity for handling high-production work as well. For low production, the transducer and work station are mounted horizontally as illustrated. Less than 9 by 36 inches of space is required for this unit. The work-piece is fed into the ultra-sonic tool which oscillates 20,000 times a second under controlled spring tension.

For high production, the transducer is mounted vertically and a specially designed adapter attached to the transducer transmits the high-frequency vibrations up to as many as eight individual tools fastened radially to the outer edge. A work station the same type as the one illustrated is located opposite each tool. The eight stations can be operated simultaneously or independently.

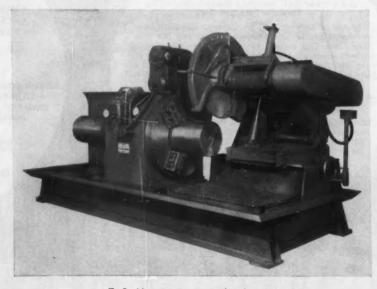
The standard machine is powered with a 1000-watt electronic generator. In applications where you need only enough power to drive one machining station, a 200-watt generator can be supplied. Used as a single-station machine, the unit is capable of machining as many as 300 dice (0.030 by 0.010 inch thick) in a 1-inch diameter wafer in less than forty-five seconds.

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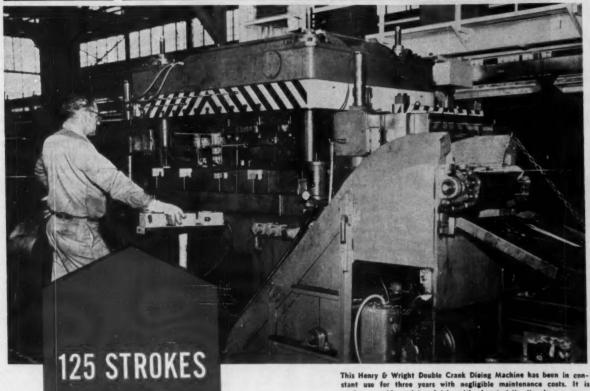
Rotator Type Abrasive Saw

An abrasive saw of the rotator type, designed for sawing hardto-cut alloys in solids, shapes, and tubing form, has been developed by the Ty-Sa-Man Machine Co., Knoxville, Tenn. Based on the principle of rotating the material as it is being cut, the saw keeps a cooler surface at the point of blade contact, resulting in a cooler cut and longer blade life. It is said to be the only rotator type saw with a chuck that will hold both rough forgings and squares, as well as conventional rounds. This equipment is designed especially for manufacturers who produce large rounds or squares in various grades of steel. Cutting time has been reduced to a minimum, and in actual plant tests, cuts up to 16 to 20 square inches per minute have been made on hard alloys. It is designed to carry up to 34-inch diameter wet abrasive wheels and is equipped with a 60-hp main drive motor with a heavy-duty Timken bearing arbor running in oil. The wheel is fed into the material by means of a hydraulic ram at a variable speed selected by the operator. The sawing assembly is mounted on an adjustable base providing horizontal adjustment of about 18 inches, which permits cutting slices from the end of the stock.

The chuck can handle up to 14



Ty-Sa-Man rotator type abrasive saw



on a wide variety of jobs with almost daily die changes.

PER MINUTE on a **300 TON PRESS**

with a

6" STROKE

This is a lot of strokes per minute for a 300-ton automatic press especially on a part requiring a 6" stroke. This is one of the reasons why The Budd Company, Philadelphia, chose high production Henry & Wright Dieing Machines. They also needed flexibility for a wide range of short-run jobs; accurate die guiding to assure minimum wear on expensive, multi-stage progressive dies averaging 8-stages each; automatic material feeding and parts ejection; quick and easy die changing . . . all so necessary to stay profitable in the highly competitive stamping business.

You'll find Henry & Wright machines will meet every production requirement. The 6" stroke, high tonnage job described in the headline is a severe test for any heavy automatic press. If you need more production, at competitive costs, for a variety of jobs, ask now about the high production Henry & Wright machines. Your inquiry will receive our prompt attention. Sizes from 25 to 500-ton capacity.

THE HYDRAULIC PRESS MANUFACTURING COMPANY

A Division of Koehring Company . Mount Gilead, Ohio, U.S.A.



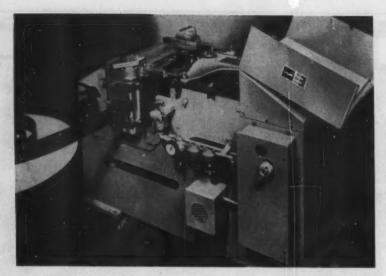


Fig. 1. Ultra-high-speed press announced by the Emhart Mfg. Co.

inches maximum outside diameter round stock in lengths up to 10 feet. The holding device consists of a double-faced chuck supported by Timken tapered roller bearings having an outside diameter of 29 inches, which are completely sealed in a one-piece steel housing. The material is placed through the eye and is securely held by a three- or four-jaw chuck combination. The material does not have to be machined or straightened in order for it to be rotated under the saw blade. Completely self-contained and portable, the saw has its own integral coolant tank and recirculation pump.

Circle 572 on Readers' Service Card

V&O Press with Specially Designed High-Speed Feed

A V&O horizontal press, coupled with a specially designed feed, capable of handling lightgage metals and nonmetallic materials at speeds in excess of 1500 strokes per minute was exhibited by the Emhart Mfg. Co.'s Hudson Division, Hudson, N. Y., at the ASTME show in Detroit. This press incorporates a vertical crankshaft with the flywheel and clutch in the base of the machine. The horizontal axis and low center of gravity give the press extraordinary stability when operating at high speeds. This compact unit is 40 inches high, 25 inches deep, and 54 inches in length.

The double-roll feed is rack-driven from a walking beam which is driven by an eccentric from the top of the press shaft. It can handle material 6 inches wide and up to a 4-inch length of feed. In Fig. 1, the press is shown with the guard opened to permit a view of the specially design roll feed. The close-up, Fig. 2, shows the walking-beam construction of the double-roll feed.

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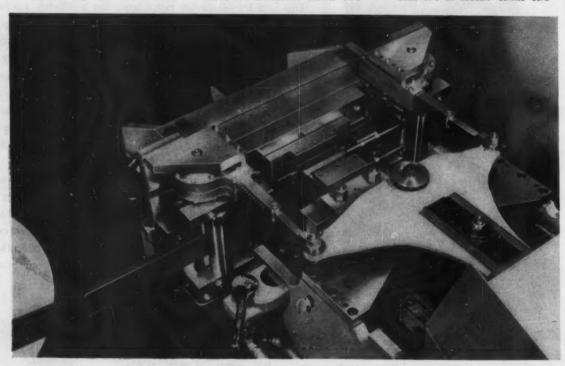


Fig. 2. Close-up of walking-beam feed on machine shown in Fig. 1

NEW BARDONS & OLIVER NO. 6 RAM TYPE TURRET LATHE

- . 3 INCH COLLET CAPACITY FOR HEAVY DUTY BAR WORK
- . 5 INCH COLLET CAPACITY FOR LIGHT DUTY BAR WORK
- 211/8 INCH SWING OVER BED WAYS



New bed, headstock, tool carrying units and aprons are properly proportioned and integrated to produce a truly functional lathe. It offers greater metal removal capacity, while holding today's most demanding tolerances!

In the design of this lathe, the operator was not overlooked. The number of operating controls has been reduced—grouped by function—scientifically located within easy reach. Generous use of aluminum and redistribution of weight results in improved balance and freer traverse of tool carrying assemblies.

For more information on how the new No. 6 can speed up your machining operations and build increased profits, contact the nearest Bardons & Oliver representative or write directly to our home office.

Bardons & Oliver, Inc., 1133 West 9th Street Cleveland 13, Ohio

NO. 6 FEATURES

- Sixteen Geared Spindle Speeds—50 to 1 speed range
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- . Fully Automatic spindle speed changes
- Twelve Fast Feed Changes for cross slide, carriage and hexagon turret
- . Single Dial Food Selectors on both aprons
- . Power Rapid Traverse to the cross slide

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Stop in at our booth and see the new No. 6 in action.

Manufacturers of Turret Lathes and Cutting-Off Lathes

Automatic Chucking Machine Designed for Finishing Operations

The Cosa Corporation, New York City, is introducing a new Pittler "Pidofat" automatic, twospindle chucking machine designed for economical internal and external finishing of castings, forgings, gears, wheels, flanges, bevels, etc., on a production or even a short-run basis. The spindles are independently driven by their own 13.5-hp motors and have eight working speeds each. The left-hand spindle is provided with a turret slide having three index positions suitable for closetolerance boring operations. A separate program-controlled compound slide provides for longitudinal and transverse cutting.

The right-hand spindle has a heavy-duty cross-slide designed for internal and external turning, and a compound slide similar to that on the left-hand spindle. The top slide is suitable for operation as a fully automatic copying device. The independently adjustable feed rate remains constant in any direction when copying. Proper working speeds are automatically obtained through an

electro-hydraulic system in accordance with program settings. Idle time for positioning of cutting tools is reduced through a built-in rapid traverse device. The maximum turning diameter is 9.1 inches; maximum swing, 9.5 inches; and speed range, 14 to 1500 rpm. The feed range is from 0.32 inch to 16 ipm.

Accessories include copying attachments, coolant pumps, a chip removal conveyor, and recessing and facing attachments. A similar single-spindle machine, called the "Pi-fat," is also available.

Circle 574 on Readers' Service Card

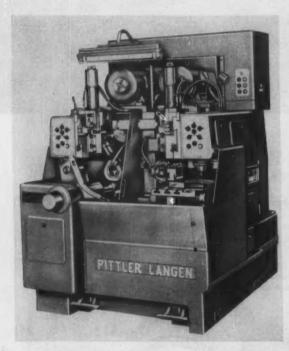
Automatic Welding, Assembling, and Spot-Facing Machine

A six-station, rotary indexing, automated welding machine that combines assembling, shielded-arc welding, reaming, and spot-facing operations in the production of motor-mount brackets is now available from the Expert Welding Machine Co., Detroit, Mich. With this automated welding equipment, production costs are said to be substantially reduced. Operations have been combined to provide maximum production rates; reduced floor space requirements; simplified part handling; and quality controlled parts.

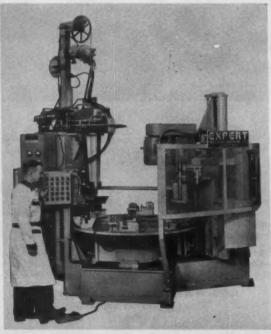
The machine illustrated pressassembles a spacer into a motormount bracket unit, welds the spacer to the motor mount in a 360-degree rotary welding operation, and simultaneously reams the inside diameter of the spacer and spot-faces the end of the spacer flush with the motormount bracket. The production rate is 360 parts per hour at 100 per cent efficiency.

This machine is 12 feet high and occupies a floor space about 6 by 10 feet. It is electrically sequenced and air-operated. Power for the cam drive is supplied by a 1 1/2-hp electric motor, and welding current is supplied by a 500-ampere rectifier.

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Pidofat automatic two-spindle chucking machine introduced by the Cosa Corporation



Automated machine for processing motor-mount brackets, built by Expert Welding Machine Co.

IT WILL PAY YOU

TO MAKE THE MACKLIN FIELD ENGINEER A PART OF YOUR PRODUCTION TEAM!

Today, automated high speed grinding of new and improved metals . . . the exact dimensional tolerances and high finishes required . . . all call for quality wheels built for the requirements of the job.

That's why it pays to consult your MACKLIN representative. He offers a complete line of "Wheels of Profit" for industry . . . wheels designed to meet the exacting needs of modern production.

> If you are wondering how MACKLIN can improve your grinding production, here's a suggestion. Contact your local Macklin distributor, or call us for the services of a field engineer. We'll be glad to prove in your own plant why it pays to use

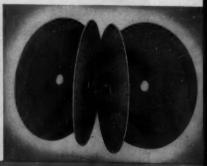
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Circle Page 191 On Cord

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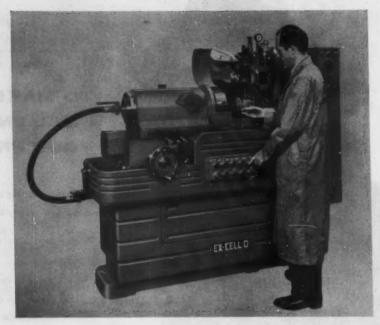
Precision Internal Thread Grinder

Ex-Cell-O Corporation, Detroit, Mich., recently shipped to a customer a thread grinder which has demonstrated unusual versatility and accuracy. Contrary to normal practice, it was required to provide this machine with a range of grinding wheel speeds suitable to

a variety of work.

The machine was equipped with standard Ex-Cell-O precision spindle arranged to run at 15,000 rpm. By changing pulleys, either higher or lower speeds are obtainable. To facilitate the grinding of small work, a Bryant high-frequency spindle was also provided which is capable of a wheel speed adjustment between 42,000 and 60,000 rpm. The two spindles were readily interchangeable to facilitate setup and minimize changeover time. Since the Bryant spindle is water-cooled, a tank and pump cooling unit was provided to effectively maintain a constant working temperature.

The Style 39-A precision internal thread grinder performs all the normal operations found on a standard Ex-Cell-O machine, including the grinding of multiple-lead threads, tapers, radius forms, and right- and left-hand threads of



Ex-Cell-O precision internal thread grinder

almost any type. Except for loading and resetting the wheel to the initial grinding position, the ma-

chine cycle is fully automatic permitting maximum production.

Circle 576 on Readers' Service Card

"Miniaturized" Single-Spindle Chucking Machine

A miniaturized single-spindle chucking automatic, designated the O-AC, has been developed by the Warner & Swasey Co., Cleveland, Ohio. Designed to bring the advantages of automatic production to small-lot producers of precision components, such as computer and guidance system hardware, this machine is capable of holding exceptionally close tolerances and producing fine finishes. It can be set up or changed over from job to job quickly and easily, and has the flexibility required to handle a wide range of work with relatively simple, lowcost tooling. The nominal working range is approximately a 3inch diameter by 3-inch long work-piece. Air chucking is used, featuring a 6-inch diameter chuck and 4 1/2-inch diameter tandem air cylinder. Spindle speed selection, and front and rear crossslide and turret feed selection are automatic.

Sixteen spindle speeds-in four ranges of four speeds each-are



Warner & Swasey miniaturized singlespindle chucking automatic



STERLING

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WHEELS

provided. The particular range desired is determined by the selection of simple change-gears. During operation, speeds may be changed automatically for each tooling station or during the cutting stroke of any one tooling station. Speeds range from 87 to 2507 rpm. Each of the four speed ranges has an 11.55 to 1 ratio. with an average increment of 2.261 between speeds. Speed changing is accomplished by means of four direct-acting hydraulic clutches operating in a constant-mesh helical gear train. Initiation of speed changes during the cycle is handled by numbered trip blocks which can be positioned easily during setup on the speed-and-feed control drum. There are no bulky cams of any type involved in setting up or job change-overs on this machine.

Three automatically selected feeds are available for use on any one job from an eighteen-feed 0.001- to 0.083-inch range. The turret and cross-slides feed at the same rate. Feeds may be changed automatically to satisfy the needs of each tooling station or during the stroke of any one station. Right-and left-hand threading gears-from 11 1/2 to 4 threads per inch-are available for solid or releasing type taps or dieheads. The O-AC also is equipped with automatic reverse for lefthand threading and for backing out solid threading tools.

One or both cross-slides may be selected to operate with any or all pentagon turret stations. Multiple-tooled turret stations combined with the machine's unusual tool-slide actions and spindle functions are said to keep tooling costs low on a variety of work.

As on other Warner & Swasey single-spindle automatic chuckers, the O-AC is of overhead turret design. Two widely spaced bearings support the forged turret bar in the same main casting as the spindle. Thus, turret and spindle bearings are subjected to the same operating temperatures, virtually eliminating spindle alignment problems caused by thermal effects. The machine is powered by a standard 5-hp main drive motor.

Circle 577 on Readers' Service Card

Farrel Roll Grinder with Trunnion-Tilt Infeed

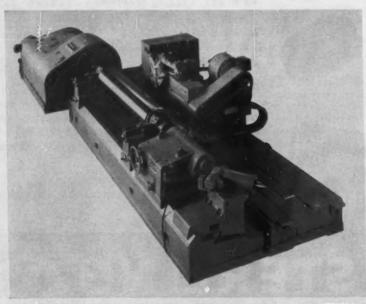
A heavy-duty roll grinder with a capacity for handling rolls up to 60 inches in diameter is the first of a new design series announced by the Farrel-Birmingham Co., Inc., Ansonia, Conn. This machine will be used for grinding steel-mill rolls up to 20 feet in length. An outstanding feature of this line of machines is the wheel-feed system which is said to provide control precision never before possible in a roll grinder. This unique design is covered by United States and foreign patents.

The trunnion-tilt, pivoted infeed system employs the same method of wheel feed as that used in the standard Farrell cam-crowning action. In previous designs, wheel infeed was accomplished by moving the wheel-head into the work on machined sub-base ways. Although much of the backlash of this system was eliminated with the advent of the ball type screwand-nut feed, the practical limitations of precision control were set by the frictional forces of the wheel-head sliding on the ways, which caused a pressure build-up and release, or "stock-slip," phenomenon.

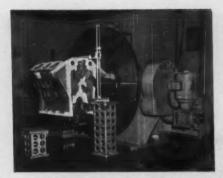
The wheel-head no longer slides on ways during infeed, but is tilted into the work by the same method used in crowning the roll. Using the same support and leverage system employed for crowning, positive infeed and withdrawal of the grinding wheel can be accomplished with extreme accuracy.

For manual control, the handwheel for infeed is graduated to 0.0001 inch and provides a control stop which allows the operator to withdraw the wheel any amount desired, then infeed it again to its previous position, smoothly, accurately, and completely without backlash. For motorized operation, rapid infeed is accomplished at 28 inches per minute; and medium feed, at 2 inches per minute under push-button control. Once the grinding wheel is in position at the roll surface, precision infeed is activated, using the trunnion-tilt method of fine infeed. Infeed may be accomplished by setting the precision feed selector to "manual" and using the graduated handwheel. As an alternate, the selector may be set at "taper" or "ammeter" to provide motorized infeed by control signal at a constant tapered infeed rate to compensate for wheel wear, or constant ammeter load for optimum stock removal rate by maintaining constant grinding wheel amperage.

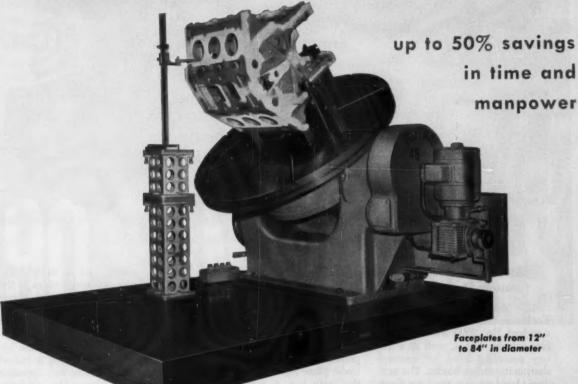
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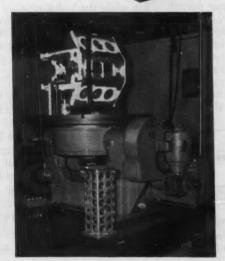


Heavy-duty roll grinder built by the Farrel-Birmingham Co., Inc.



Dimensional check on 7 planes in one set-up!





Yes... every angle, diameter, straight line, every critical surface, on seven different planes of a V-type block, completely accurately checked without disturbing the initial set-up! How is it possible? With Machine Products' ROTAB universal rotary positioning table, that's how.

And consider the advantages. Previously, this same operation required two men, who had to "wrestle" the block into seven separate set-ups... each time re-establishing the locating point. With ROTAB the V-block is loaded on the horizontally positioned table, locating point determined, block clamped in place. Then, ROTAB's precision, movable graduated ring is set at zero to start the angular or radial check, and one man, using motor-powered, push button tilting and rotation runs the entire inspection, saving up to 50% in time, increasing accuracy, reducing rejects.

This, briefly, is what ROTAB has accomplished for one of the nation's leading diesel engine manufacturers.

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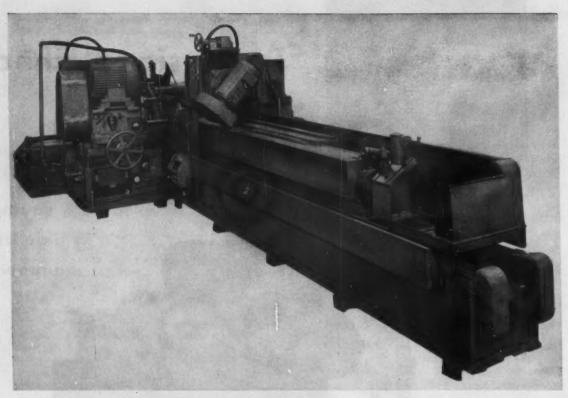


Fig. 1. Mattison traveling-table grinder equipped with auxiliary tracer head

Mattison Traveling-Table Face Grinder Equipped for Contour-Sharpening the Blades of Rotary Crop Shear

The Mattison Machine Works, Rockford, Ill., is now equipping its standard No. 2000 traveling-table face grinder, Fig. 1, with an auxiliary swiveling head for contoursharpening cutter blades. The auxiliary head of this machine floats laterally and is controlled by a tracer to reduce part-handling time and costly special equipment for grinding complex work. This machine is set up for grinding the male and female blades of a rotary crop shear such as shown in Fig. 2. These blades cut a large radius at the leading edge of steel slabs for easier feeding into the rolling mills. Either a male- or femaleblade die may be placed on the new grinder, and two compound angles of the shear blade sharpened simultaneously in a curvilineal plane at the cutting edge of the knife bar. A combination of counterweighting and antifriction spindle-carriage mounting permits the wheel to follow the desired shape, as controlled by a roller cam moving along the template.

To provide antifriction mounting, one set of hardened steel balls is mounted between two V-ways at a 45-degree angle to support the weight of the swiveling head,

while another set is wedged between two opposed V-ways in the horizontal plane to absorb thrust loads. The auxiliary head is easily dressed by two manually operated dressers mounted on a special base at one end of the table. The hydraulically driven table is pulled in both directions by two opposing cylinders to provide uniform, smooth travel. The outer way is flat, while the V-shaped inner way takes lateral thrust and guides the table. This design is said to assure excellent finish and accuracy when grinding shear blades, wear strips, and similar parts.

The Mattison No. 2000 face grinder with auxiliary tracer head handles work lengths ranging from 50 to 220 inches. The spindle may be driven by motors of from 25 to 40 hp. Any flat part that requires a combination stock-removal facing cut and a contour-finishing operation can be put on this machine. Straight, flat surfaces and contour edges or faces can be machined in two simple setups.

Circle 579 on Readers' Service Card

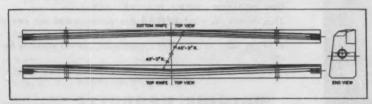


Fig. 2. Top and bottom knives of rotary crop shear with large radius at leading edge ground to compound angles on machine shown in Fig. 1



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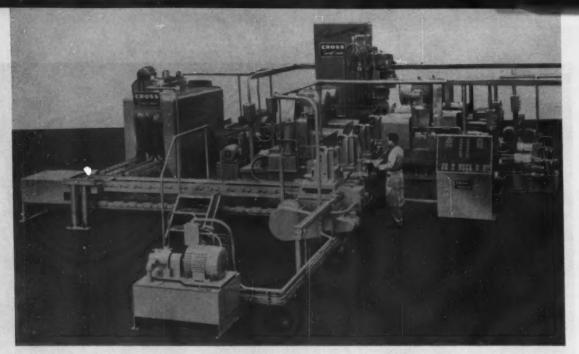


Fig. 1. Four different heavy axle housings for tractors are finished in this Transfer-matic in three machining stations

Transfer-matic Equipped to Process Rear-Axle Housings

Rear-axle housings for tractors are being automatically processed in a way that assures concentricity of the bearing seats, mounting flange, and counterbore. The equipment employed is a Transfer-matic built by The Cross Co., Detroit, Mich., on which four different housings are processed. This machine (Fig. 1) requires only minor adjustments in changing from one housing to another. Production requirements for any of the housings, two of which are shown in Fig. 2, do not exceed twenty-eight per hour. The heaviest work-piece weighs pounds. The primary objectives of this transfer machine are improved accuracy, reduction in operating costs and lower capital cost.

These objectives have been met by doing all the roughing operations in one station and all the precision finish boring and facing operations on both ends of the housings in another station, thus maintaining close alignment tolerances between the two ends. Each of the cutting tools in these two stations is separately adjustable. Another unusual design feature is the use of two heads and one bushing plate that index longitudinally so that successive feed strokes can drill and ream or tap accurate holes without moving the work-piece.

The gray-iron housing castings have hardnesses ranging from 187 to 241 Brinell. The bores in these parts, Fig. 2, are held to tolerances of plus or minus 0.001 inch. Two dowel holes in the flange are positioned relatively to each other and to the bores of the part within tolerances of plus or minus 0.001 inch. These holes are reamed to a size tolerance of 0.001 inch. During the designing of the housings, the four different parts were given locating points in the same vertical planes, as measured from the back of the bells. Because of this, all parts can be accurately and securely clamped in the same simple fixture-pallets, Fig. 3, with a minimum of adjustment between runs.

A work-piece is manually loaded and automatically clamped in the fixture-pallet at Station 1. A rotary transfer bar moves the pallet to succeeding stations. In the second station, three roughboring, one fixed-facing, and two chamfering cuts are taken in the smaller (back) end of the workpiece; and four rough-boring, two generating-facing, and two chamfering cuts are taken on the bell end. Similar, but fewer, finishing cuts are taken in the third station. In this station, both ends are precision bored and faced, maintaining close alignment tolerances between the two ends. A combination of the separately adjust-

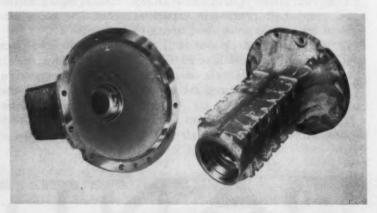
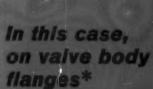
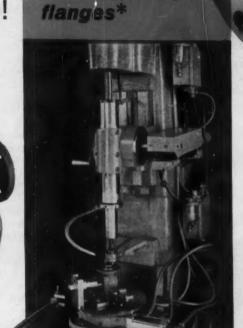


Fig. 2. Typical tractor rear-axle housings that are finished on the Transfer-matic shown in Fig. 1

HERE'S DRILLING AUTOMATION ... dirt cheap!





Problem: "On this Continental Manufacturing job, we have various valve body sizes in tough-machining materials, hole diameters to ¾", and small lot runs up to 25 pieces. To make it a profitable operation, we must have low-cost equipment with fast setups for quick changeovers."

Answer: Standard 21" CINCINNATI, "tailored" with standard air-operated feed and table indexing . . . simple, flexible fixturing for approximately 5 minutes setup time . . . 2½ to 5 minutes cycle time depending on material . . . total equipment cost slightly under \$4000!

Let Cincinnati Lathe and Tool service engineers tailor a versatile new CINCINNATI Drilling Machine to suit your needs exactly! You get a specialized unit made with the right combination of standard accessories—the most practical approach to LOWEST COST PER DRILLED HOLE!



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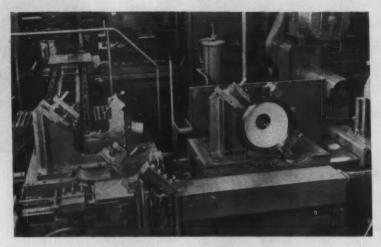


Fig. 3. Details of the fixture-pallets on machine shown in Fig. 1 can be seen in empty pallet at left. A raw casting has been loaded and clamped in fixture at the load-unload station

able boring and facing cutters on two spindles effectively reduces the number of stations required in the Transfer-matic and also serves to increase accuracy.

All drilling, chamfering, reaming, and tapping operations are accomplished by one vertical and one horizontal head in the third and last machining station. The vertical head, its bushing plate, and the horizontal head are mounted on longitudinal shuttles so that successive passes can be made by different tools in the same holes without moving the

Fig. 4. Station 4 with horizontal head that performs all drilling, reaming, and tapping operations in bell end of housings

work-piece. The floating bushing plate for the horizontal head does not index because it "plugs" into the chamfered main bore of the work-piece to maintain accurate location. Extra holes are provided in the bushing plate and clearance is provided in the fixture to accommodate noncutting tools during the feed strokes of the head in its two positions.

The horizontal head, Fig. 4, carries drills for all of the flange holes in the bell end of the housing. After the holes have been drilled, the tools are withdrawn from the floating bushing plate, and the head is indexed sideways so that reamers can finish two dowel holes in the flange as the head feeds inward again. The vertical head feeds downward to drill two holes in the top of the workpiece. After the drills have been withdrawn, the head and bushing plate are indexed sideways so that the holes can be tapped as the head feeds downward again. There is sufficient clearance so that unused tools do not interfere on the alternating feed strokes.

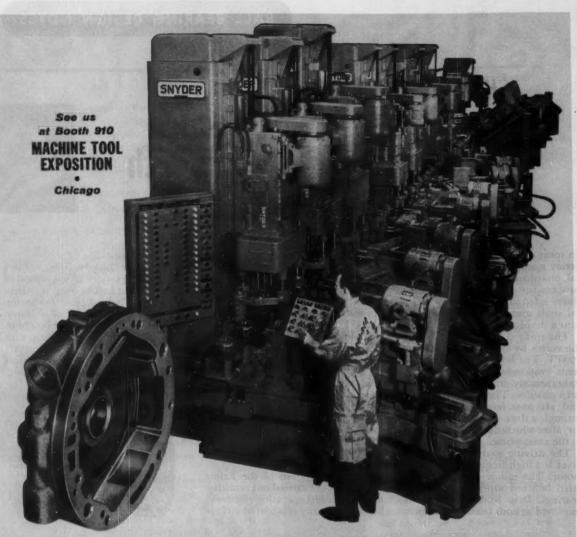
Separately adjustable cutting tools are used for all boring and facing operations. The tool carriers are different for each of the workpieces but only a few different types of carbide blades are needed. The two generating-facing tools are standard throw-away holders held in a single tool-block. Many of the drills, taps, and reamers can be used for more than one work-piece, which minimizes tool changing between runs. The dowel holes are reamed with six-fluted, straight carbide reamers.

In Station 4, the horizontal adjustable-spindle head is used with a different floating bushing plate for each housing. Only one bushing plate is required for the vertical head. Speeds and feeds are the same for each part but depths of cuts have to be adjusted.

Circle 580 on Readers' Service Card

Emergency Oxygen Unit

A portable medical oxygen supply, for use in emergencies, is being marketed throughout the United States and Canada by distributors of Linde Company, division of Union Carbide Corporation, (Continued on page 214)



SNYDER BUILDING-BLOCK PRINCIPLE MAKES TRANSFER MACHINES VERSATILE, CONVERTIBLE, THRIFTY

Transfer machines built up on the "building-block" principle are old stuff at Snyder and we've built all kinds of them—including the ones that turn corners and bring the part back to where it started from, processed from half-a-dozen angles, gaged, probed, automatically inspected in process, washed and dried and rejects marked for re-processing. Nothing to it if that's what the job calls for. We call it the Snyder Building-block Principle.

Here's an example of a fairly simple Snyder building-block transfer. This 58 station machine performs 74 operations on an automatic transmission pump body, drilling, reaming, tapping, gaging and probing 180 parts an hour at 100% efficiency. Any or all of its 22 segments can easily be converted to perform comparable operations on other parts. Also, the number of segments can be reduced or increased at any time, as need dictates. Your inquiries are invited.

SNYDER

(Formerly Snyder Tool & Engineering Company)

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How Fafnir Ball Bearings help spray dryer manufacturer get

Reduced bearing costs with no loss in efficiency

In spray dryers produced by a New Jersey manufacturer for the chemical, pharmaceutical, food, and other process industries, a solution or slurry is fed through a hollow, vertical shaft and centrifuged outward into a drying chamber.

The spray is forced into a wheeling vortex by air heated to 200°F to 1000°F. The hot, turbulent air currents evaporate the water and instantaneously transform the solids into powder. The dried products and air pass from the chamber through a duct to a product collector, after which the air is exhausted to the atmosphere.

The driving source of the spray dryer is a high frequency induction motor. The motor armature is located between super-precision ball bearings. Drip feed lubrication is employed at both bearing locations.

At the lower location, an aspirator prevents lubricant from working out into the machine's drying chamber.

During recent redesigning, the manufacturer called on Fafnir to review proposed bearing specifications. The original design incorporated duplex pairs of super-precision bearings mounted back to back.

After studying the loading and service conditions involved, Fafnir engineers advised the manufacturer that single, spring-loaded, superprecision bearings, rather than duplex pairs, would provide the necessary capacity, support, and service life. A similar recommendation was made for a new spray dryer unit then under consideration.

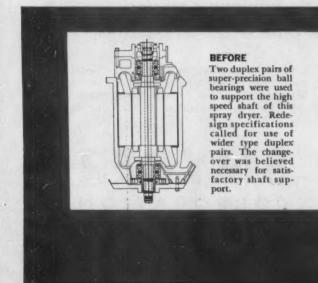
Recommendations of the Fafnir engineers were carried out resulting not only in full operating efficiency, but also effecting substantial savings in bearing costs.

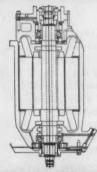
This case history from Fafnir's engineering service files is typical of thousands of ball bearing problems Fafnir has helped solve for manufacturers in every field of industry. For information about the ball bearings described here, or for help with problems you may have, contact your Fafnir branch office nearest you, or write The Fafnir Bearing Company, New Britain, Conn.



AFTER

Fafnir Super-Precision Ball Bearing — Preloaded, angular-contact bearings, equipped with composition retainers, are widely used in precision-built mech-





Fafnir engineers, after a study of loadings and service conditions, advised that a single, superprecision ball bearing at each location would provide ample rigidity. The change resulted in substantial savings at no sacrifice in operating efficiency.

NEW CATALOGUES

· Yours for the asking . . . Use postcard inside back cover



Hacksaw Blade Tips

Atkins Saw Division, Borg-Warner Corporation, Indianapolis, Ind. Three different lines of power blades and four lines of hand hacksaw blades are described in Folder 1-110-60. Included are a trouble shooter's guide and a speed-feed chart.

Circle Item 501 on Inquiry Card



Plastic Blister Packager

Sundstrand Machine Tool, Belvidere, Ill. Model 58 Packmaster, which seals small parts in clear plastic blister packages, is presented in Catalogue PG 58-1. The literature describes phases of operation, and specifications for packages are included in table form.

Circle Item 507 on Inquiry Card



Gear-Tooth Hardening

Philadelphia Gear Corporation, King of Prussia, Pa. "Full Tooth Contour Induction Hardening of Large Gears," Bulletin 100, describing the company's process and equipment for doing this work. Advantages are explained. Sketches, drawings and graphs.

Circle Item 502 on Inquiry Card



Diamond Tools

Staset Co., Inc., West Orange, N. J. A comprehensive line of 232 standard industrial diamond tools for dressing grinding wheels is offered in Catalogue 460. It contains alphabetical listings of grinding machines and the recommended diamond weight and quality.

Circle Item 508 on Inquiry Card



Rotary Shaft Seals

Garlock Inc., Palmyra, N. Y. Compact ready-to-install, rotary shaft seals are described in Bulletin AD-150 on the Mechanipak line. Selection and ordering information is given, with line drawings and cut-away views. Tables list standard and optional features.

Circle Item 503 on Inquiry Card



Cold-Heading Die Steel

Uddeholm Co. of America, Inc., New York City. Pamphlet describes a water-hardening vanadium tool steel for cold-header dies. Properties of the alloy, called UHB 19-VA, are stated, with analyses and complete instructions for forging and heat-treatment.

Circle Item 509 on Inquiry Card



Pull-Pin Ejector Punches

Ring Punch & Die Division, Producto Machine Co., Bridgeport, Conn. "The Punch Line" describes a line of pull-pin ejector punches that are sharpened easily and fast even with close center distances and tight groupings. All point shapes are available.

Circle Item 504 on Inquiry Card



Components for Hydraulic Systems

Denison Engineering Division, Columbus, Ohio. Hydraulic pumps, vane and axial-piston fluid motors, and flow control, directional control, remote control, and pressure-control valves are presented in Bulletin 146 F. All components are for 5000 psi circuits.

Circle Item 510 on Inquiry Card



OBI Presses

Federal Press Co., Elkhart, Ind. Geared and flywheel open-back, inclinable mechanical presses are presented in Catalogue 1015. Capacities range from 7 to 125 tons. Descriptions cover design features and attachments for automation, air clutching.

Circle Item 505 on Inquiry Card



Cutting Tools

Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence, R. I. General Catalogue 38 contains 128 pages, combines several bulletins covering design data on end mills and milling cutters in high-speed steel and carbide in B&S and Nelco lines.

Circle Item 511 on Inquiry Card



Air-Tube Clutches, Brakes

Wichita Clutch Co., Wichita Falls. Tex. Application ideas abound in a 32-page catalogue presenting the company's line of air-tube disc clutches and brakes. Design specifications and dimensions of the clutches and brakes are included in the literature.

Circle Item 506 on Inquiry Card



Retaining Ring Pliers

Industrial Retaining Ring Co., Irvington, N. J. Four types of pliers for applying and removing retaining rings are shown in a folder which includes complete table descriptions of the tip styles available in both external and internal models.

Circle Item 512 on Inquiry Card

• Yours for the asking. . . . Use postcard inside back cover



High-Velocity Machining

Kennametal, Inc., Latrobe, Pa. Brief case histories of nine high-velocity machining jobs describe the performance of throw-away inserts made of Kentanium Grade K165. The two-page bulletin tabulates complete data on setups and work-pieces.

Circle Item 513 on Inquiry Card



Man-Made Industrial Diamonds

Metallurgical Products Dept., General Electric Co., Detroit, Mich. Brochure DM 595 recounts history of man-made diamonds and describes the three different structures now available for industrial grinding in metal-, resinoid-, and vitrified-bonded wheels.

Circle Item 519 on Inquiry Card



Steel Shelving

Penco Div., Alan Wood Steel Co., Oaks, Pa., offers angle shelving, T-line shelving, steel lockers, bookcase shelving, wire bucket storage units, and service truck shelving in Bulletin DC-60. Tables list dimensions of the different storage units illustrated.

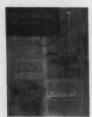
Circle Item 514 on Inquiry Card



Portable Electric Tools

Millers Falls Co., Greenfield, Mass. A complete line of electric and hand tools is catalogued in Form DE-158. Included are hammers, sanders, impact wrenches, drills, grinders, saws, shears, and attachments in both standard and heavy-duty models.

Circle Item 520 on Inquiry Card



Camshaft Gear Shaving

National Broach & Machine Co., Detroit, Mich. How to do faster and better shaving of engine camshaft gears is told in Bulletin CS60-1 describing Red Ring Model GCU diagonal gear shaver. Data given on the process, traverse angle, and cutter selection.

Circle Item 515 on Inquiry Card



Natural Diamonds

Industrial Diamond Division, Engelhard Hanovia, Inc., Newark, N. J. Diamonds for grinding wheels are described in Form 6124, "This is SND" (selected natural diamonds). The properties of natural diamonds in various shapes are summarized and illustrated.

Circle Item 521 on Inquiry Card



Designing for Copper Brazing

Superweld Corporation, North Hollywood, Calif. "How to Design for Superwelding." describes copper brazing in electric furnaces built by this company. The brochure lists "do's" and "don'ts" in joint design, material selection, determination of bond area.

Circle Item 516 on Inquiry Card



Automation and You

Industrial Electronics Division, General Electric Co., Schenectady, N. Y. "Automation and You" discusses the technology, equipment, and economics of data and computer control mechanization systems. Describes applications and improved management.

Circle Item 522 on Inquiry Card



Collapsible Taps

Landis Machine Co., Waynesboro, Pa. Style ALT collapsible taps are covered in Bulletin G-94-2. Information concerns detachable tap heads, rotary models, collapsing action, size adjustment, chasers, and deep-hole tapping. Specifications and clearance diagrams.

Circle Item 517 on Inquiry Card



Air-Hydraulic Boosters

SP Mfg. Corporation, Cleveland, Ohio. Air at 80 psi can be converted to hydraulic pressure at 3000 psi using the boosters and methods described in Catalogue 116. Included are several charts on booster and cylinder selection, hydraulic pressure, and flow.

Circle Item 523 on Inquiry Card



Gage Blocks

Fonda Gage Co., Stamford, Conn. Rectangular and square gage blocks in steel and carbide appear in Catalogue 9-1. Numerous accessories are included, together with each main class of gage blocks and the company's inspection services are listed.

Circle Item 518 on Inquiry Card

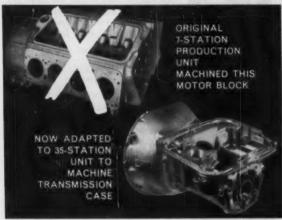


Custom Dies

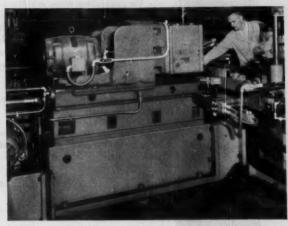
S. B. Whistler & Sons, Inc., Buffalo, N. Y. Facilities for engineering, designing, manufacturing, and trying-out custom dies are described in a 4-page brochure. The complete machine tool roster is included and die tryout service and equipment explained.

Circle Item 524 on Inquiry Card

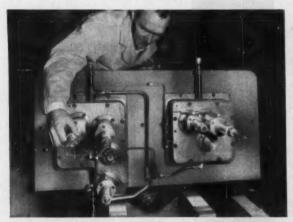
How Barnesdril Transfer Machines Save Money Through Flexibility!



BarnesdriL units regroup easily . . . economically. A leading automobile manufacturer, for instance, is reducing the costs of tooling for a new transmission case by using BarnesdriL units from an obsolete motor block line built to the "Building Block" principle. "Before and after" parts are illustrated.



This "obsolete" unit will go right on producing! That's because BarnesdriL unit and slide assemblies are separate. Base and column sections are separate, too, for widest possible flexibility. Units have inserted hardened and ground steel ways, with saddle type construction to reduce height of auxiliary heads.



By simply replacing the "pot" this unit can be adapted to major styling changes. All "pot type" heads are used on this line. Pallets used to hold the work fixtures also can be re-used when the machine is rebuilt. Since pallets rise very little from the rest pad for indexing, they automatically sweep chips into the flume.



This duplex milling head is combined with drilling, tapping, reaming, boring, and facing units on the new 35 station machine. Gross production rate is one case every 36 seconds. For easy maintenance, hydraulic cylinders on BarnesdriL units can be removed by loosening 4 bolts and uncoupling the tie rod.

Get the complete story in cost-cutting BarnesdriL Production Units . . . write for catalog 150-D Today !



Honing Machines / Production Units / Filtration Units / Drilling Machines

BARNES DRILL CO.

820 Chestnut Street • Rockford, Illinois DETROIT OFFICE — 13121 Puritan Avenue • Yours for the asking. . . . Use postcard inside back cover



Metal Powders

Powder Metallurgy Dept., Vanadium-Alloys Steel Co., Latrobe, Pa. Packaged powder metals, ready mixed for the compacting press, are described in "Prealloyed Metal Powders." The back cover of this 8-page folder lists valuable tooling tips for compacting.

Circle Item 525 on Inquiry Card



Toolroom Equipment

Producto Machine Co., Bridgeport, Conn. A leaflet briefly describes the company's Model VT-1 hand tapping machine, Model DA1P die assembler, Model F4 toolmaking machine, and three special vises. The time-saving and safety features of each item are listed.

Circle Item 531 on Inquiry Card



Industrial Lubricant Additive

Elco Lubricant Corporation, Cleveland, Ohio. An additive called SCL is the topic of LubeReport 102, a 12page brochure. The fine performance of heavy industrial greases compounded with SCL forms the text of the literature. Four case studies included.

Circle Item 526 on Inquiry Card



LINK BELT

Variable-Speed Drives

Link-Belt Co., Chicago, Ill. Folder 2874 describes the unique design of the company's Type RS constant-horsepower variable-speed drives. Selection procedures are carefully outlined for drives which cover demands to 50 hp and ratios up to 51/2 to 1.

Circle Item 532 on Inquiry Card



Variable Speed Sheave

T. B. Wood's Sons Co., Chambersburg, Pa. A newly revised Bulletin 6102 increases technical information and gives new price listings for a line of adjustable-pitch multiple V-belt sheaves. They provide accurate speed control; no freezing or lubrication.

Circle Item 527 on Inquiry Card



Grooved Drive Belts

Dayton Industrial Products Co., Melrose Park, Ill. Booklet A2343 tells the design advantages of Poly-V endless drive belting employing longitudinal V-ribs running in mating sheaves. Graphs show how they trim costs and space.

Circle Item 533 on Inquiry Card



Submerged Arc Welding Rigs

Linde Co., division of Union Carbide Corporation, New York City. Submerged arc CO2 welders, torches, flux, welding wire, and other accessories in the Unionarc line, are the topic of Bulletin F-1379. The literature describes the process and its controls.

Circle Item 528 on Inquiry Card



Brush-Backed Polishing Head

Grinding & Polishing Machinery Corporation, Indianapolis, Ind. The Vonnegut polishing heads described in revised Bulletin 114 are illustrated doing a number of unusually productive operations. All specifications listed besides a table of machines.

Circle Item 534 on Inquiry Card



Motor Drive Control

General Electric Co., Schenectady, N. Y. A direct-current adjustable-speed drive with electronic conversion is described and illustrated in Bulletin GEA-7018. Named the Thymotrol speed variator, it uses the Thyratron tube to convert a-c to d-c power.

Circle Item 529 on Inquiry Card



Muffles and Hearths

Rolock Corporation, Fairfield, Conn. Muffles and hearths for horizontal furnaces are described in Catalogue Section 10 which outlines important facts in design and instruction for longer life. Company has repair and reconditioning services.

Circle Item 535 on Inquiry Card



Carbide-Tipped Saws

W. F. Meyers Co., Inc., Bedford, Ind. Three lines of circular saws with carbide-tipped teeth are catalogued in Form U 2548. Certain of the saws are for metal, while other versions are adapted to cutting plastic, Transite, and various woods.

Circle Item 530 on Inquiry Card



Slide Assemblies

Russell T. Gilman, Inc., Grafton, Wis. Standard slide assemblies for straight-line precision movements are covered in detail in Catalogue 1000. The booklet contains all dimensions and information needed to build the equipment into automated setups.

Circle Item 536 on Inquiry Card



RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY



Technical-ities

By Fred E. Graves

No difference between hex and cap screws

It's not the name of a standard fastener that determines whether to use it for a particular application, but vice versa. The application requirements for strength and tolerances dictate the fastener.

Thus, if you have a joint that calls for certain tolerances in a screw, obviously the one which satisfies those tolerances is the right fastener.

IDENTICAL STANDARDS

In the case of cap screws and hex screws, the standards will show you that these are merely different names for the same product. They're actually made on the same machines, to identical tolerances, and from identical materials.

No reason then to differentiate. For tapped holes, merely specify Hex Screws (SAE Grade 2) or High Strength Hex Screws (SAE Grade 5), and you'll get the right fastener with the quality needed.

For bolted joints, these same items are supplied with nuts when specified.

This should suggest a way you can extend standardization in your plant . . . and benefit from our new simplification of nomenclature which calls any fastener with head on one end and threads on the other a screw; and a screw plus nut a bolt.

See how "holding power" can cut fastener costs

SIZE	SAE GRADE	SAE PROOF LOAD	COST RATIO
34"	Gr. 5	28,400 lbs.	100%
1″1	Gr. 2	16,950 lbs.	188%
11/8"	Gr. 2	21,350 lbs.	239%
11/4"	Gr. 2	· 27,100 lbs.	277%

Since the usual job of a threaded fastener is to hold an assembly tightly together, its clamping force is what you're really utilizing. This seems obvious. But how best to get the clamping force needed for the joint design? Not so obvious. Looking at size alone can be misleading . . . and quite costly, as the chart above demonstrates.

HOLDING POWER MEANS MORE THAN SIZE

SAE "proof load" of four different hex screws of standard steels, along with typical cost ratios, are compared. Almost unbelievable, isn't it? Yet it's a fact that the smallest of the group—the heat treated SAE Grade 5 RB&W High Strength Hex Screw exceeds all the others in load capacity. It can be used in place of any of the others in most normal usages.

Since it's smallest and therefore weighs the least, it also costs less... 64% less than the 1¼-inch grade

2 hex screw; 58% less than the 1½-inch; 46% less than the 1-inch. And since holes can be made smaller, there are also the savings in production drilling . . . and possibly in materials, too.

DESIGN ADVANTAGE

Remember, too, that smaller fasteners are more easily torqued to higher preload levels...which helps keep joints tight, makes them more vibration-proof.

If you would like to explore this approach to fastener economy and better utilization of "holding power," consult with an RB&W specialist. Let him contribute his fastener knowledge to your design and production needs. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa., Pittsburgh; Detroit; Chicago; Dallas; San Francisco. • Yours for the asking. . . . Use postcard inside back cover



Fastener-Fitting Seals

A.P.M. Corporation, Yonkers, N. Y. Single-unit high-pressure seals and fasteners described in 16-page Catalogue 359A permit the sealing of equipment without redesign or rebuilding. Many military, marine and industrial applications for these components are listed.

Circle Item 537 on Inquiry Card



Infrared Heating Devices

Radcor, Inc., Bradner, Ohio. Two series of infrared ovens and heating equipment are covered by Catalogue BRG 100. The lines include modular oven sections that can be assembled by the customer as required. Wattage of different heat sources is included.

Circle Item 543 on Inquiry Card



Hole Gages

Mayes Tool Co., Detroit, Mich. A hole relation gage, Con-Chek, is announced in Bulletin M-12. Included are six standard models and six special ones for checking shoulder squareness, thread bushings, double-action, variable pilot hole, and spline pilot.

Circle Item 538 on Inquiry Card



Large Investment Castings

Engineered Precision Casting Co., Matawan, N. J. Large, heavy investment castings are made by Shell-Kote, a new method described in a 4-page folder. The technique employa a wax pattern but uses a self-supporting ceramic mold instead of solid molds.

Circle Item 544 on Inquiry Card



Gears and Gear Boxes

Cincinnati Gear Co., Cincinnati, Ohio. The personnel and equipment to manufacture precision custom gears and gear boxes are the subject of a 36-page brochure. Engineering data includes tables of tooth parts, spur gear proportions, spline shafts, fittings.

Circle Item 539 on Inquiry Card



Steel Tubing

Pacific Tube Co., Los Angeles, Calif. A comprehensive 20-page manual, Catalogue 60, details materials, size ranges, mechanical and physical properties, and selection for the mechanical, pressure, and aircraft tubing produced by West Coast's first tube mill.

Circle Item 545 on Inquiry Card



Electron Beam Welding

Air Reduction Sales Co., New York, N. Y. The method and equipment for electron beam welding on a commercial basis is announced in Form ADC 937. It describes this method of effectively joining ferrous and nonferrous superalloys.

Circle Item 540 on Inquiry Card



Motor Selector

Howell Electric Motors Co., Howell, Mich. Alternating-current motors manufactured by a recently merged group of companies are catalogued in brochure L-1661A. Sizes range from ¼ to 300 hp. A variety of motors are listed with applications.

Circle Item 546 on Inquiry Card



Grease Cups

Lubriquipment Engineers, Inc., Fort Worth, Tex. Bulletin on a lubricating device providing automatic feeding and visual control. The grease cups and their function on equipment are the subject of a comprehensive series of questions and answers.

Circle Item 541 on Inquiry Card



Source for Stampings

Laminated Shim Co., Glenbrook, Conn. "Better Service on Stampings," is the title of Folder 3 which outlines the company's three different stamping techniques. They are "one plus," short run, and production run. "Watch dog" service is also available.

Circle Item 547 on Inquiry Card



Spring Mounts for Machinery

Korfund Co., Inc., Long Island City, N. Y. Data on stopping vibration, shock, and noise transmission by using steel spring machinery mounts is contained in Bulletin K3C. Series "L" Vibro-Isolator is described. Eight case histories are included.

Circle Item 542 on Inquiry Card



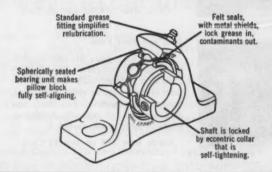
Shielded A-C Motors

Sterling Electric Motors, Los Angeles, Calif. Complete pricing and dimensional data on the company's line of A-C Multi-Shielded motors from ½ to 200 hp. Special sections cover electrical modifications, mechanical modifications, motor selection, applications.

Circle Item 548 on Inquiry Card



hoover quality PILLOW BLOCK BALL BEARINGS



Simplify bearing application problems caused by inaccuracies of assembly or machining of equipment. Use *Hoover Quality* SP series pillow block ball bearings that adjust automatically to shaft misalignment in any direction.

Installation is quick and easy. Elongated bolt holes in the base of the pillow block simplify mounting. Eccentric collar forms a self-tightening shaft lock.

Hoover Quality features assure long, trouble-free life under normal duty and shock load conditions. SP series pillow block, flange bearings and machine units are available in shaft sizes from 3/4" to 215/6".

Thoower

BALL AND BEARING COMPANY

5400 South State Road, Ann Arbor, Michigan

Zone Sales Offices and 8581 South Chicago, Chicago 17, Illinois 290 Lodi Street, Hackensack, New Jersey 2020 South Figueroa, Los Angeles 7, California

Hoover Ball and Bearing Co 5400 South State Road, Am	ompany in Arbor, Michigan	M-1
Please send information	on SP series pillow blocks.	
☐ Have your representative	re call.	
Name		U.S
Title	The day of Avelance and the second	3
La Company of the last of the last	Constitute of the second	
Company		
Address		

· Yours for the asking. . . . Use postcard inside back cover



Tool Crib Control

Remington Rand, New York City. Case History 1256 tells how the company's Kolect-A-Matic visible record system has provided three-way control and replaced "gesstimating" with error-proof tool crib operation in the shop of an automotive parts supplier.

Circle Item 549 on Inquiry Card



Tube Fittings

Lenz Co., Dayton, Ohio. Catalogue of original equipment and replacement tube fittings, featuring "O-Ring Seal" fittings. Each specification table is coupled with a drawing, with product dimensions keyed to the table. Illustrated index for fitting reference.

Circle Item 555 on Inquiry Card



Better Centers

High Precision Products Co., Westfield, N. J. "A Guide to Better Centers" explains the importance of concentricity of centers, illustrates aix different errors that can be found in centers, and explains how correction is made with Technica center grinder.

Circle Item 550 on Inquiry Card



Reading a Micrometer

J. T. Slocomb Co., South Glastonbury, Conn. Bulletin "How to Read a Micrometer" describes principles of operation, and instructions on reading to 0.001 and 0.0001 inch. Three different settings are used as examples. Also, company's "Speedmike" instructions.

Circle Item 556 on Inquiry Card



Air Presses

Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 85 describes company's new line of single-acting air presses for punching, swaging, staking, and assembly operations. Twentyeight models are offered: capacities, ½ to 2 tons; 85 psi; six control systems.

Circle Item 551 on Inquiry Card



Jig Borer

Moore Special Tool Co., Bridgeport, Conn. "The 10 Musts of a Jig Borer" is a check list with illustrations of what a good jig borer has: accuracy, long life, fast settings, fast tool changes, fast spindle speed changes, sensitivity, etc.

Circle Item 557 on Inquiry Card



Bearing-Race Grinder

Bryant Chucking Grinder Co., Springfield, Vt. Bulletin on Model B Centalign internal grinder designed for handling miniature and instrument bearing races. Available in two versions, for ball tracks and for bores, each needs 8½ square feet of floor.

Circle Item 552 on Inquiry Card



Carbide Tools

Wesson Co., Detroit, Mich. Bulletin MF-360 contains specifications on carbide-tipped end mills, straight and taper shank end mills, straight and taper shank reamers, core drills, lathe centers, counterbores, and universal angle vises. Supersedes Catalogue 546.

Circle Item 558 on Inquiry Card



Peel Type Shims

Laminated Shim Co., Inc., Glenbrook, Conn. Design Folder 3 on Laminum shims which look like solid metal but can be peeled off for adjustment in 0.002- or 0.003-inch layers. Available in brass, mild steel, stainless steel, and aluminum.

Circle Item 553 on Inquiry Card



Iron and Steel Rolls

Badall Co., Inc., Hammond, Ind. Catalogue on company's line of hardened iron and steel rolls. Contains sections on heat transfer rolls, carburizing, design, heat-treating facilities, and dual-metal chilled iron rolls. A relative-hardness table is also included.

Circle Item 559 on Inquiry Card



Screw Conveyor Drives

The Falk Corporation, Milwaukee, Wis. Bulletin 7106 on screw conveyor drives for application of ½ to 30 hp, in four ratios, designed to bolt to standard trough ends. Accessories include trough end seals, removable driveshaft, and optional motor mounts.

Circle Item 554 on Inquiry Card



Alloy-Steel Tools

Vanadium-Alloys Steel Co., Latrobe, Pa. Leaflet on Vasco Supreme tool bits, flats, and squares. Chemical analysis of the metal is given, as well as a representative list of the materials successfully machined. Tables give flat bit weights and sizes.

Circle Item 560 on Inquiry Card



4 ways to cut the cost of high-conductivity parts

There are now four free-cutting, high-conductivity Anaconda coppers that broaden the combinations of mechanical, physical, and fabricating properties available for boosting production and cutting costs of high-conductivity parts. They are furnished chiefly in rod and bar, but are available also as extruded shapes and, except for the leaded coppers, die-pressed forgings of simple design. All have good cold-working properties.

Leaded Copper-126 and Deoxidized Leaded Copper-129 have slightly higher electrical conductivity—98% IACS annealed, 95% IACS, minimum. The difference between them is that Alloy 129, being deoxidized, is not subject to hydrogen embrittlement when annealed or furnace-brazed in reducing atmospheres. Neither leaded alloy is recommended for hot working.

Tellurium Copper-127 and OFHC* Sulfur Copper have an electrical conductivity rating of 95% IACS annealed, 90% minimum. Both may be extensively hot worked

and neither is subject to hydrogen embrittlement. Tellurium Copper-127 has the advantage of retaining its mechanical properties at temperatures higher than those tolerated by the other free-cutting coppers—and hence is widely used in the welding and cutting-tip field.

The free-cutting coppers may be machined at cutting speeds approaching those used for machining Free-Cutting Brass. For Tellurium Copper-127, however, carbide-tipped tools are recommended as the inherent copper telluride particles cause somewhat greater tool wear.

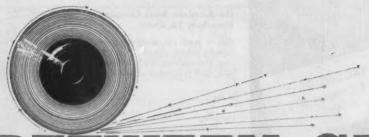
*Rogistered Trudemark of American Metal Climax, Inc.

GotT Rev. **GotT Rev.

ANACONDA

FREE-CUTTING HIGH-CONDUCTIVITY
COPPER PRODUCTS

Made by The American Brass Company



By E. S. Salichs

BETWEEN GRINDS

Fitting Facts

"Noah Knew a Thing or Two" is the title of a very readable paper prepared by Albert M. Dexter, director of metrology at the Pratt & Whitney Co., Inc., by way of celebrating the centennial of the company. He opens with the sentence "Someone once wrote that the progress of civilization runs parallel to how closely man can measure," and proceeds to quickly describe the units of measure developed through the ages. Mr. Dexter brings us up to today's needs for measuring to tolerances of a millionth of an inch, and the role that P & W has played in spreading accuracy throughout the world by means of its gages.

Masked Metal

Style has been brought to steel. You will soon see the metal with multicolored and embossed patterns worked right into its surface, and with some, the feel of a piece of fabric. How will you know it is steel? The usual way—stub your big toe on it.

Fix-it Fiesta

Chrysler Corporation ran its sixth annual trouble-shooting contest recently in sixteen cities throughout the country. Identical malfunctions were placed in current-model Plymouths. Nearly 1000 high school students who had demonstrated automotive mechanical ability competed on two-man teams to get the cars operating, and drive them a prescribed distance. It was nice that Junior didn't have to use the family car for practicing.

Pep Through Paint

Experiments at Johns Hopkins University indicate that violet, blue, and green surroundings tend to relax the mind, while yellow, orange, and red

tend to stimulate it. We always thought there were too many green rugs and walls in offices but never knew why.

Duped by Ductility

Plastic design is a significant development in structural-steel construction, according to Steelways. Seems that "sidewalk superintendents" will have a hard time noticing the change, however, for the structural shapes will look about the same but will be lighter in weight. Until now, construction engineers have never fully utilized the characteristic of ductility in steel.

Shot with Luck

A sixteen-year-old, on his way to an antique dealer, was recently arrested in New York City for illegally possessing firearms. He was released however, when testimony showed that modern bullets would not fit his century-old gun.



ELEPHANTS MEET IN CHICAGO—To emphasize the lengthy preparation needed to install the elephantine machines being shown in September at the NMTBA Exposition in Chicago, one of the first to arrive on June 6 (a Giddings & Lewis heavy-duty, precision drilling machine) was skidded off the flatcar by elephant power. The elephant was furnished by a circus that was currently playing the Chicago International Amphitheatre, which also will be the location of the Machine Tool Exposition. This task was all in-a day's work for the elephant, but officials decided that more conventional equipment would serve as well for moving the rest of G&L's million-dollar, fifteen-machine shipment.

These Remarkable
Precision Tubing
Finishes
and

Tolerances

are Economically Produced with the

CINCINNATI° Intraform



I.D. and O.D. less than 10 micro inches

TOLERANCES

0.D. to ± .001" I.D. to ± .0005" Ovality to .0002"

MATERIALS

Welded or seamless: Zircaloy Nos. 2 and 3, stainless alloy, and plain or carbon steels. Intraform can also produce laminated tubing of two or more dissimilar metals.

If you make or buy precision tubing, these remarkable tolerances and finishes are important to you! Visit us, write for information, or better still, let us send you a Meta-Dynamics Division Field Engineer to expertly translate Intraform into benefits you can expect from specific application to your operation.

Intraform
META-DYNAMICS DIVISION
Metal Forming and Heating Machines
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.
CINCI NATI

New York City. Called "Lif-O-Gen," the unit provides about 7 gallons of pure gaseous oxygen, U.S.P. It is only 11 inches high, 3 inches in diameter, and weighs only 20 ounces.

Oxygen can be administered instantly by merely pressing a pushbutton on the top of the container. A disposable face mask, included with the unit, can be attached to the outlet. Oxygen can be administered intermittently or continuously.

These inexpensive units can easily be stored in strategic locations throughout factories and public buildings where they will be immediately available to aid anyone in a respiratory crisis. They can be stored indefinitely.

Circle 581 on Readers' Service Card

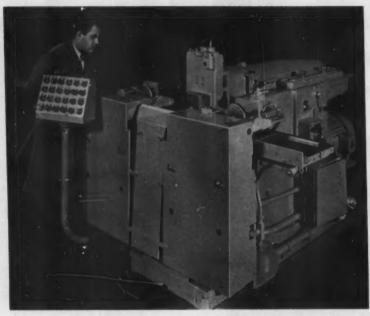


Fig. 1. Rockford fully automated hydraulic shaper

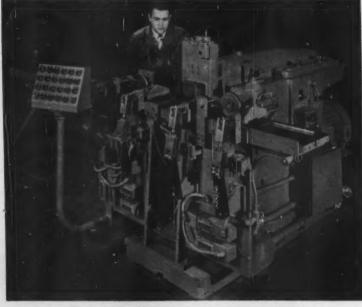


Fig. 2. Shaper shown in Fig. 1, with covers removed

Hydraulic Shaper with Full Automation

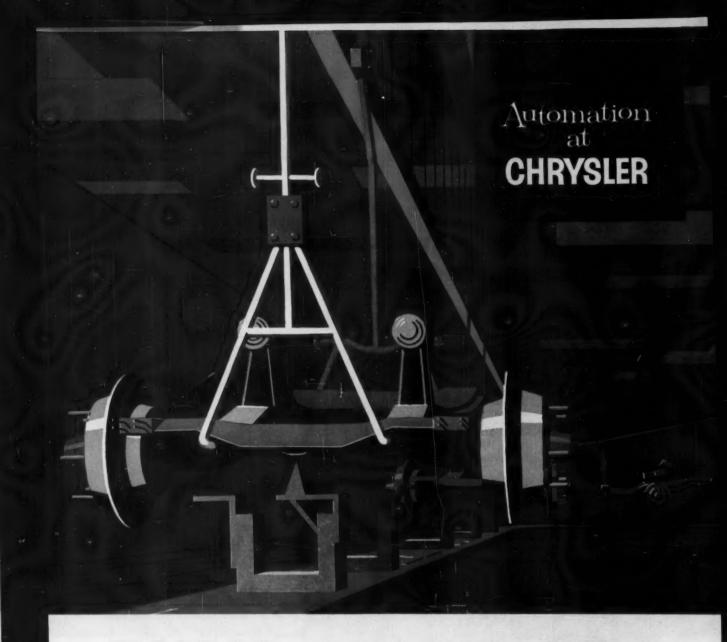
A hydraulic shaper with full automation, believed to be the first of its kind, has been built by the Rockford Machine Tool Co., Rockford, Ill., for conveyor line production of sleeve bearings. With a fully automatic cycle, including loading and unloading, this shaper finish machines one vertical and one angular surface on the edge of each of two steel plates simultaneously. The plates are then bent into a circle and butt-welded to form the shell for a sleeve bearing. Machining is completed in nine cutting strokes, utilizing a cutting speed of 50 fpm and a return speed of 100 fpm. The operator simply starts the machine which then runs until stopped.

This standard Rockford Hy-Draulic 24-inch shaper is equipped with a special cross-rail and toolhead. There are two tool-holders and tool gages for presetting the tools. Four standard high-speed steel tool bits with identical grinds are used. The trailing edge of one plate and the leading edge of the following plate are machined in the cutting sequence. When the tools have cut to the predetermined depth, the tool-head is raised automatically and pneumatically indexed against positive gage-stops to position it for machining the next pair of plates. One plate is loaded while another is being ejected to conveyor. No attention required from operator other than changing dull tools.

Clamping, tool relief, and tool positioning are hydraulically controlled. The tool-head has positive mechanical feed. Down feed of the tool-head is controlled through ratchet-feeding a drum cam and the use of a hydraulic cylinder which holds the tool-head against the cam. This same hydraulic cylinder is used to obtain tool relief on the return stroke by reversing the hydraulic pressure.

Built-in safety devices protect the operator and prevent damage to the machine. The transfer table is interlocked with the shaper so that the cycle is interrupted in case of malfunctions. The machine is powered by a 10-hp 220-440-volt motor having a speed of 1200 rpm.

Circle 582 on Readers' Service Card



VARIDYNE a/c drive system synchronizes assembly conveyors



Problem: Chrysler Corp., Dodge Division, new unitized body assembly lines required linkage of three variable-speed, continuous motion conveyors—stub frame overhead, main assembly pedestal and final assembly flattop. At transfer point, shown above, pin in conveyor must match hole in frame with no cumulative error.

Solution: U.S. VARIDYNE a/c Drive System with LinkSync control. Chrysler engineers working with

U. S. Motors field engineers chose Varidyne over a d.c. system because: initial start-up is simplified; instantly synchronous without warm-up; needs no synchronizing readjustments; there is no cumulative error; and maximum reliability is assured by use of standard a.c. motors. Varidyne varies the frequency of a.c. current to these motors, converting them to adjustable speeds. Write today for Varidyne Brochure F-1963.



U.S. ELECTRICAL MOTORS INC.

P. O. Box 2058, Los Angeles, California or Milford, Connecticut

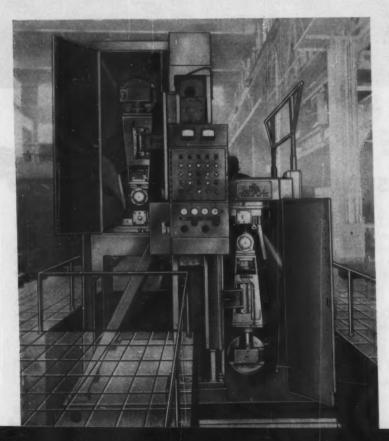
MACHINERY, August, 1960

For more data circle this page number on card at back of book



General-Purpose Superfinisher

The Gisholt Machine Co., Madison, Wis., has announced a new Gisholt Masterline 51B general-purpose Superfinisher. This machine is designed to provide the highest flexibility obtainable. The simple bed is closed on three sides but is open on the front for



easy access to the lubricating pump. Mounted on the bed are a headstock, a tailstock, and a vertical platen. Tailstock and vertical platen are mounted in T-slots for easy positioning.

The platen is furnished with a self-contained reciprocating unit on which can be mounted one or two stone-carrying quills. Work is held between centers or in a chuck, collet, or fixture. It can also be supported on rollers. To the basic machine can be added a second vertical platen to permit superfinishing as many as four different areas simultaneously. For work that may require positioning of the upper head to permit ease of loading and for internal work, a means for moving the stone quill 4 inches longitudinally can be provided. This feature, along with all other machine functions, is incorporated in the completely automatic machining cycle.

Circle 583 on Readers' Service Card

Strip-Grinding Machine

A machine designed to process 54-inch wide stainless-steel strip, grinding both sides simultaneously, has been built by the Hill Acme Co., Cleveland, Ohio. This machine eliminates the need for turning over the coiled strip as is usually done when both sides of the material must be ground.

It consists primarily of two Hill vertical abrasive-belt grinding heads—one head in the normal position and one in the inverted position. Each head is driven by a 125-hp motor and uses a 56-inch wide abrasive belt. The base of the machine is located 36 inches below floor level to reduce the pass-line height of the stainless strip. The over-all machine height is approximately 13 feet.

The grinder is recommended for removing imperfections prior to cold-rolling operations and for final finishing of coiled strip. With modifications it may be adapted for use as a "feed roll" type machine for processing cut strips.

Circle 584 on Readers' Service Card (This section continued on page 220)

Hill-Acme strip-grinding machine



diamonds...gold...carbide

He is watching the first . . . add a touch of the second . . . to the third

The best cutting tools deserve the best sharpening wheels. The economy and improvement which carbide-tipped tools bring to their cutting jobs are brought to the tools themselves by sharpening with Norton diamond wheels of man-made (SD) diamond.

The cost-cutting, product-improving "Touch of Gold", created by Norton leadership in diamond wheel development, began back in 1930. Norton was

first to introduce all three bond types of diamond wheels . . . and produces the largest line.

largest line.

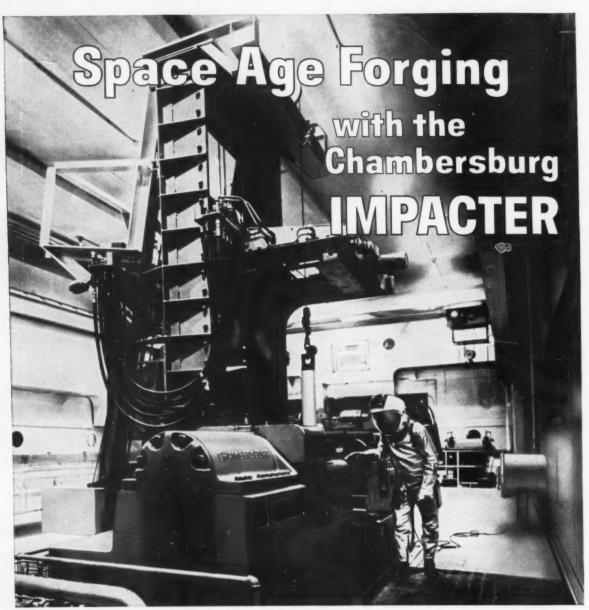
Today, similar pioneering continues
Norton leadership in the application of
both mined and man-made diamonds to
provide better performance, longer service life and lower grinding cost. Your
Norton Man, a trained engineer, and your
Norton Distributor will be glad to tell you
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be brought to your own production. NORTON COMPANY, General Offices, Worcester 6, Massachusetts.



75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives . Grinding Whoels . Machine Tools . Refractories . Electro-Chomicals .. BERR-MANNING DIVISION: Coated Abrasives . Sharponing Stenes . Pressure-Sensitive Tapes



Today's forging problems will not be solved with yesterday's forging equipment

THE IMPACTER: Designed and built by Chambersburg, pioneers in the development of machinery for forming metals by impact. In this revolutionary forging tool, the stock is struck from both sides by horizontally opposed rams. No shock, no vibration.



At the amazing new InFab project of Universal-Cyclops at Bridgeville, Pa., a Chambersburg Impacter is employed to forge ingots of molybdenum and other "exotic" metals in an atmosphere of pure argon gas, in which the workers have to wear space suits. The Impacter was selected primarily because of its instantaneous impact. At temperatures up to 4500° F, the Impacter strikes the ingot on two sides with 15,000 ft. lbs. of force; yet the impact is instantaneous and the transmission of heat to the die faces momentary. Other advantages are the Impacter's lack of shock or vibration, necessitating no heavy foundations, and the thorough working of the metal, deformation taking place equally on both sides. Learn more about this modern method of forging. Write today to Chambersburg Engineering Company, Chambersburg, Pa.

CHAMBERSBURG

DESIGNERS AND MANUFACTURERS OF THE IMPACTER

ACTUAL TESTS' PROVE

Allen-Bradley Standard Duty Push Buttons can be installed

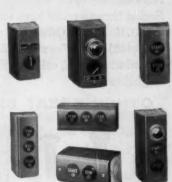


In accurately timed tests, Allen-Bradley standard duty push buttons required about half the installation time—on the average—than each of four other popular makes. This saving in installation time means "dollars" saved on the job. How come only the famous A-B standard

duty push button possesses this time and moneysaving advantage? The answer lies in the molded, wrap-around cover—which also contains the contacts. When the cover is removed, the wiring terminals are out in the open—ready for wiring—and you have plenty of working space. The two cover screws are captive—they cannot fall out and get lost. And with the contacts in the cover, they are protected against accidental damage and careless wiring. Naturally, these push buttons have double break, silver contacts that never need service attention. There are two concentric knockouts on each end of the base, which are removed from the outside—the heavy, pressed steel base will not bend out of shape.

Your local A-B distributor has these Bulletin 800 push buttons in stock. Call him today—you'll save time and money on your next job.

*Using recognized standard duty push buttons, installations were made by an experienced electrician under identical conditions. He was not connected with Allen-Bradley Company in any manner.



A-B STANDARD DUTY PUSH BUTTONS Made as a one., two-, or three-unit station—with pilot light available. Readily changed for horizontal or vertical mounting. Convertible two- or three-way selector switch supplied with or without pilot light.

ALLEN-BRADLEY

Allen-Bradley Co., 133) 9 min S., Milwaukee A, Wha . In Concelle: Allen-Bradley Concelle Ltd., Gall, Ontari

QUALITY MOTOR CONTROL



Blue Devil

LED-LOK SAF-LOK SCREWS

Perfect seal for hydraulic ap plications as well as air and any type gas. Designed to give good results in minor vibration problems. Available in standard socket screw

For severe vibration problems requiring high torque. Special inserts of brass, bronze, aluminum or stain-less steel capable of with-standing high operating temperatures.



So Differenteyre Now Patented!

Although any of the well-satisfied users of LED-LOK and SAF-LOK Socket Screws could have told you they're outstandingly different, the U.S. Patent Office has made it "official" (No. 2,884,038 and 2,923,340). If you're still looking for a screw that's really air-tight or vibration-proof, call for Blue Devil. One of our distributors will be glad to help.

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NEW HAVEN

NEW YORK CITY

"Adjust-O-Matic" Gage and "Core-Rector" Cutters

An "Adjust-O-Matic" gage permitting instant, accurate reading of adjustable boring and reaming tool diameters and a "Core-Rector" cutter have been designed by Muskegon Tool Industries, Inc., of Muskegon, Mich. The gage, Fig. 1, reduces the need for a micrometer in adjusting tool diameters. It permits adjustments to 0.0001 inch in approximately ten seconds per tool, according to the report. This gage consists of a steel holder in which the tools are placed and a dial type indicator graduated in 0.0005 inch. The operator needs to measure only one tool to establish the desired size, place it in the holder, and adjust the indicator to zero reading. Each succeeding tool of the same size can simply be placed in the holder and adjusted to the zero reading, assuring an accurate setting.

In adjusting tools of various diameter sizes, the operator uses a micrometer to read the current setting on each tool before placing it in the Adjust-O-Matic gage. He then expands the tool to the desired size while reading the amount of adjustment in 0.0005inch graduations on the indicator face. Indicators graduated in 0.0001 inch are also available.

(Continued on page 222)



Fig. 1. Adjust-O-Matic gage for boring and reaming tool diameters

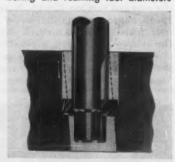


Fig. 2. Core-Rector adjustable cutter for boring cored holes made by Muskegon Tool Industries, Inc.

Gage Blocks of CARMET Chromium Carbide



for new standards of dimensional control!

For enduring, ultra micro-accurate surface finishes and dimensional stability, CARMET Chromium Carbide represents the ultimate gage block material.

Harder by nature than steel . . . next to a diamond in hardness, yet far tougher . . . Chromium Carbide Gage Blocks withstand rougher use, eliminate costly dimensional errors, and cut frequency of calibration and replacement. They have a thermal coefficient of expansion similar to steel. Fingerprints are not harmful.

Lightweight, non-oxidizing, possessing superior "wringability" and a stable, fine grain structure that takes and holds a mirror-smooth gaging surface... CARMET Chromium Carbide in gage blocks is leading the way to rigid new standards of dimensional control.

Carmet doesn't make gage blocks, but furnishes the chrome carbide to the progressive manufacturers who do.

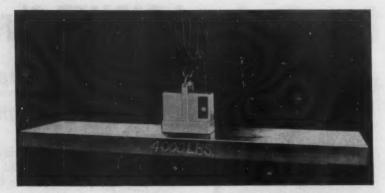
A precise blend of extremely hard, finely divided carbides of chromium with a nickel binder, CARMET Chromium Carbide assures predictable, consistent behavior and unmatched uniformity from piece to piece.

These same unique characteristics make CARMET Chromium Carbide an important material for extrusion dies, valve seats, sealing rings, chemical processing equipment . . . or any other application where resistance to oxidation, corrosion, abrasion, erosion or chemical attack may be involved. For more information, contact your local Allegheny Ludlum CARMET representative, or write: Allegheny Ludlum Steel Corporation, Carmet Division, Ferndale, Detroit 20, Michigan.

CARMET A

The Core-Rector cutter was designed to eliminate core drift in boring cored holes, Fig. 2. These tools are said to produce a true hole, even though the cored hole deviates from the center line of the work-piece. The cutters incorporate a special grind to eliminate a deflection normally encountered in machining off-center cored holes by conventional methods. The cutters perform equally well in boring drilled holes. They can be used on turret lathes, chucking machines, or radial drills.

Circle 585 on Readers' Service Card



Magna Lift electrical lift magnet

Heavy Duty Vertical



Heavy Duty Offset



Universal Milling Attachment



Toolmakers Overarm

Send coupon for FREE Comparison Chart and detailed descriptive literature, on easy-to-use attachments.

Heavy duty attachments increase versatility of dependable, low-cost

GREAVES MILLS

"THE MOST MILL FOR THE LEAST MONEY"

A full line of attachments and accessories offer outstanding flexibility for all types of milling operations . . . with GREAVES MILLS.

Make your own comparison of 22 specifications of Greaves and 7 other leading milling machines.



Electrical Lift Magnet

Because of its self-contained power supply, the new "Magna Lift" can be used anywhere without being connected to an electrical power line. Scores of lifting jobs, indoors and out, are handled easily and safely with this Magna Lift, brought out by the Hanchett Magna-Lock Corporation, Magnetic Chucks & Devices, Big Rapids, Mich. This magnet has a 4000pound plus lifting capacity. It is powered by a built-in standard replaceable dry-charge battery, has a built-in charger with a plug-in receptacle, and a control panel.

Circle 586 an Readers' Service Card

Single-Acting Air Presses

A line of precision-built, singleacting air presses introduced by Niagara Machine & Tool Works,



Niagara precision-built air press

You can do more with

Costs cut 50% in multiple hole drilling



Delta 17" Drill Press, also 20", 15", 14" and 14" Super-Hi Sensitive. Available in floor, bench and multiple-spindle models.

Suspending a standard 17" Delta drill press from an angle iron wall bracket over a table not only doubled productivity, but resulted in greater accuracy in wide panel drilling work for S & S Visual Company, a Brooklyn display firm. Use of a Commander multiple spindle drill head permits simultaneous drilling of up to 15 holes in a line 35" long. Avoiding costly single-purpose equipment, the firm used versatile, standard Delta components for this relatively inexpensive installation.

Every model in the world's most complete drill press line offers the power, precision performance and ruggedness that have set industry standards for years. Delta drill presses give you better value for your money—they cost less to buy, less to operate and less to maintain.

To match the tools to your needs, visit your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages). And for a FREE Delta Industrial Catalog showing 61 machines, 302 models, over 1400 accessories, write: Rockwell Manufacturing Company, Delta Power Tool Division, 614H N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL





Buffalo, N. Y., can handle numerous assembly jobs, as well as a wide variety of other industrial work. Twenty-eight models offer a wide selection for punching, swaging, staking, upsetting, and imprinting operations plus the seating and removal of close-tolerance bearings and bushings. Featuring four press sizes ranging from 1/2- to 2-ton capacities at 85 psi, the new line includes a choice of three air and three electrical control systems. Four specialized applications, electronic timers, speed control valves, and pressure limit controls are available.

Stroke lengths and shut heights are infinitely adjustable within the range of each press size. Rugged cast frames are designed to assure minimum deflection under severe loads and maximum accuracy on critical jobs. A diaphragm type, frictionless air cylinder which requires no lubrication provides continuous production and maintenance-free service. Where job requirements demand, the standard round ram adapter is quickly replaced with a special adapter to accommodate a wide assortment of punches and dies. All models may be bench mounted or furnished with a floor stand of rugged, steelplate construction.

Circle 587 on Readers' Service Card



Flush Pin Gage for Hydraulic Port Contours

Go-Not Go flush pin gage brought out by Craig Tools, Inc., El Segundo, Calif., for manufacturers of hydraulic port contour cutters. This combination flush pin and Go-Not Go gage is designed for checking the critical O-ring seat dimensions designated diameter D and depth E called for on AND 10050 Military Specifications. The gage is exceptionally simple to use, accurate and ideal for both in-process inspection and final inspection of port contours after machining. It is made of hardened alloy steel in thirteen sizes.

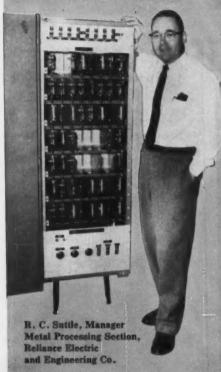
Circle 588 on Readers' Service Card

GOSS and DE LEEUW

Illustrated literature available promptly on request. Send samples of your work for time

MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

"Reliance V*S drives give American Can accurate system control for highspeed production."



"Precise system control for acceleration, deceleration and shearing is a vital contribution to this cut-to-length tin sheet line. A VSC voltage regulator controls acceleration on the unwind and leveler sections, and provides stepless speed changes. Unwind tension is accurately controlled by a VSR current regulator... and the entire drive is powered by Reliance D-c. motors.

"The speed of the shear is matched to the line by photoelectric loop control, maintaining loop position and assuring accuracy.

"Surface defects in the sheet are picked up visually pin holes electronically. Mechanical gauges check uniform thickness. Rejects are dropped automatically following the shear. Automatic counting cuts handling time as the usable sheets are stacked on pallets."

These lines were developed by the F. J. Littel Machine Company, Chicago, and American Can Company and are installed in Canco Division plants.

Reliance engineers are ready to help you as they have many others, with a sound understanding of system problems and solutions. Consult your Reliance sales engineer . . . or write today for Bulletin Number L-2505 for complete information.

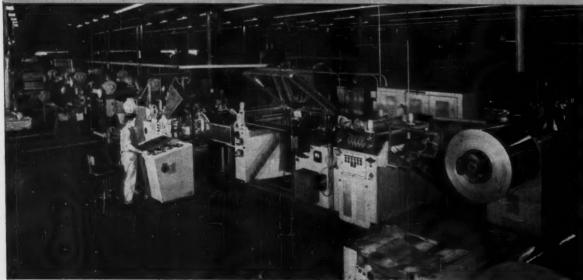
Product of the combined resources of Reliance Electric and Engineering Company and its Master and Reeves Divisions

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Duty Master A.c. Meters, Master Gearmeters, Reeves Drives, VaS Drives, Super 'T' B.c. Meters, Generators, Controls and Engineered Drive Systems.



Low-Cost Polishing, Buffing, Deburring, and Brushing Lathe

Lathe incorporating all the advantages of top performance machines, but stripped of all unnecessary "frills" to keep costs at a minimum, now being produced by the Murray-Way Corporation, Birmingham, Mich. Practically the entire cost is allocated to a top-quality spindle assembly, which is mounted on a simple, sturdy base. The spindle runs in perma-



its specifications add up to high production capacity Logan No. 6565 14" Lathe Logan designs greater reliability and accuracy, and longer life into its lathes by a generous combination of high-capacity features. For instance-An oversize spindle with 1%" bore turns on four super-1458" swing over bed precision ball bearings with built-in preload A variable-speed drive lets you change speed while work 9" swing over saddle cross slide is turning-without shifting belts A warp-free lathe bed with high, strong walls braced by eversize ribs to withstand heaviest stresses; two V-ways and two flat ways are flame-hardened and precision-ground. There are many more reasons why this and other Logan Lathes have a greater capacity. The complete specifications tall the story. Write for them.

nently lubricated bearings within a cast-iron housing. Labyrinth seals prevent dirt from entering the housing. The lathe capacity is from 10 to 20 hp. Speeds may be varied by changing the multiple V-belt motor sheaves. Spindle overrun when motor is stopped is controlled by a convenient hand brake. Distance from spindle housing to inside wheel flange is 8 inches, and width between flanges on standard lathe is 6 inches. Arbors may be ordered in 1 1/2- to 2-inch diameters. The machine requires a floor area of 43 by 34 inches.

Circle 589 on Readers' Service Card

Compound-Angle Sine Table

Matrix high-precision compoundangle sine table, accurate to within 10 seconds of arc, available from Engis Equipment Co., Division of Engineering and Scientific Instrumentation, Chicago, Ill. This sine table is of particular value for the inspection of jigs and gages used on grinding and jig-boring machines. The illustration shows



the 9-inch size. Four other sizes-13, 18, 26, and 36 inches in diameter-are also available. An outstanding feature of this equipment is the hemispherical member riding in a conical seat that permits setting the table to any angle (single or compound) up to 45 degrees. The hemisphere takes the place of the conventional 90degree hinged bearings. Other advantages claimed for this table include greatly increased rigidity, higher and more lasting accuracy, and a working surface always over the center of the base. The sine settings are obtained by the insertion of gage-blocks underneath two ball-ended pins which are spaced 90 degrees apart. One of the pins is located to ride against

LOGAN ENGINEERING CO. Dept. K-860 4901 Lawrence Avenue. Chicago 30, Illinois



Select from full lines to operate and control a single OEM product ... or a plant's entire production line!

Air circuits perform no better than each component. In addition to quality air cylinders and valves, you need accessories of proven reliability. Schrader has them in full lines to make compact, rugged air systems that will install easily, perform tirelessly. See your Schrader distributor who has everything you need, plus factory-trained experts to give you ideas and assistance.



The complete range of sizes and types of air circuitry products is stocked and cataloged by your Schrader distributor. Consult the yellow pages or write Schrader.



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QUALITY AIR CONTROL PRODUCTS

NEW...IMPROVED...model 15A



for high-profit, low-cost punching, notching and nibbling...for prototype, short and medium production runs

FEATURING the new Strippit Electro-Hydramatic Head—simplified design...minimum number of parts...needs no pressurized air. Makes the 15A easier to install, simpler to maintain, more economical to operate.



punches

any round or shaped hole up to $3\frac{1}{2}$ " diameter in sheet material — up to $\frac{1}{4}$ " mild steel.

notches

90° corners — rectangular, radii, vee and special shape edge notches — up to $\frac{1}{8}$ " capacity in mild steel.

nibbles

straight line or contour shearing up to 38" diameter circle, at 165 strokes per minute, $\frac{1}{8}$ " mild steel.

accurate, quick-set gauging

a unique, multiple-stop system for exact work positioning to any layout specifications — in seconds.

guick-change punches and dies

from one size to another in less than 20 seconds — within easy reach in labeled, built-in file drawers.

easy conversion

to a high speed production punching unit with the Strippit Duplicator and the Dupl-O-Scope or Microbars to punch Duplicator templates.

WRITE TODAY

for new Catalog 15A and demonstration at your own plant of the capabilities of this high-profit fabrication system.



WALES

STRIPPIT INC.

203 Buell Road . Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ontario

the vertical face of a detachable bracket, so that the first inclination of the table will be in a plane at right angles to the datum abutment faces machined on the base. When setting is completed, the gage-blocks are removed and the table is locked. The table can be used also with auto-collimator and angle gage-blocks for optical settings of angles.

Circle 590 on Readers' Service Card

Chandler Boring and Facing Tool Heads

Several new features are embodied in their 1960 Chandler duplex combined boring and facing tool head, claims Chandler Tool Co., Muncie, Ind. Outstanding among these improvements is a new means of attaching the shank to the body which precludes all chance of looseness or breakage of shank. Another important change is a decrease in the body height of one full inch. This gives more rigidity and stamina to the tool, minimizing any tendency toward weakness or chatter. Dual means for take-up of wear has been incorporated that keeps the tool in perfect adjustment at all times. End play in the feed-screw is eliminated through adjustments in the graduated dial at rear end of body. All adjustments can be made quickly from the outside without losing time.

Circle 591 an Readers' Service Card



(This section continued on page 230)

BOOTH 1339

MINSTE

first in press design

1960 MACHINE TOOL EXPOSITION

September 6-16



International Amphitheatre
Donovan Hall

Chicago, Illinois

THE MINSTER MACHINE COMPANY

MINSTER, OHIO

MEMBER OF THE NATIONAL
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ALLEN



Your ALLEN Industrial Distributor can show you a good many ways to use ALLEN Dowel Pins, in addition to conventional uses in tool and die work. You can use them as economical roller bearings, axles, precision plugs, hinge and wrist pins—and in many other ways.

You can cut the cost of your product substantially, too—because your ALLEN Distributor can supply these strong, accurate, mirror-finished Dowel Pins in standard sizes right from stock.

Made of special Allenoy steel; surface hardened to 62-64 Rockwell C; precision ground to .0001" with micro-inch finish of 6 RMS max. Check your Allen Handbook or Catalog for detailed speca and standard sizes, or write direct for samples and technical information.



Genuine ALLEN products are available only through your ALLEN Distributor—he's always ready, willing and able to give you prompt, practical service.



ALLEN MANUFACTURING COMPANY

HARTFORD 1, CONNECTICUT, U.S.A.



Dual-Purpose Port Contour Cutters

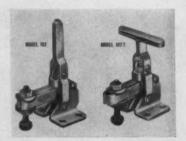
One of a line of improved carbidetipped port contour cutters for AND 10050 standard hydraulic fittings brought out by the Wetmore Tool & Engineering Co., Los Angeles, Calif. These cutters come in a complete range of sizes for machining tubes with outside diameters ranging from 1/8 inch to 2 inches. The cutters have precision-ground bodies for bushing guidance and are equipped with a removable tap hole reamer that may be interchanged with an optional end pilot. This construction offers two tools in one and may be set up to suit the requirements of the job-using the tap hole reamer or end pilot, as required. Tool construction is of the four-flute type, and each flute is ground to evenly distribute the chip load and to achieve balanced cutting for fine finish, accuracy, and prolonged tool life.

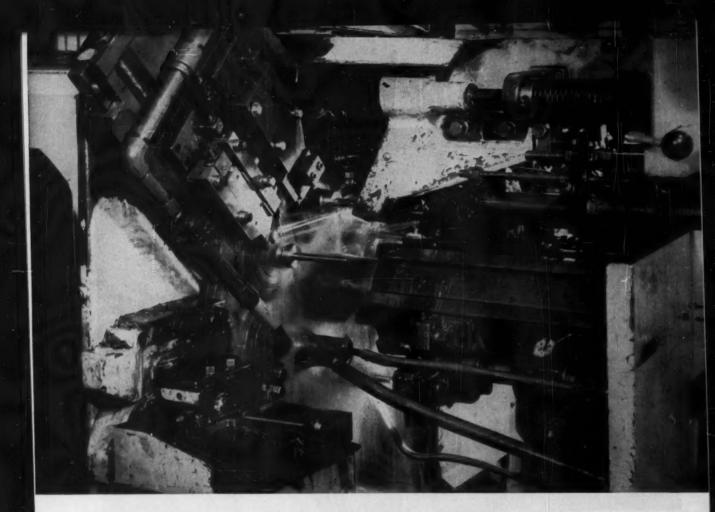
Circle 592 on Readers' Service Card

Miniaturized Toggle Clamps

Two miniaturized, vertical-handle toggle clamps having a rated holding pressure of 100 pounds have been added to the standard line of clamps manufactured by Detroit Stamping Co., Detroit, Mich. Available with either a straight vertical handle, designated Model 102, or a T-handle known as Model 102T. Both models are available with a straight base if desired. The clamps are designed for light-duty

(Continued on page 234)





TOUGH, ON-THE-JOB TESTS LIKE THESE CONVINCE USERS

Texaco Cleartex Performs Better

ON BOTH CUTTING AND LUBE SIDES!

Company A: a leading bearing manufacturer (name on request).

Job: forming and cut-off of 52100 and C-1118 tube stock for bearing races.

Had been using: three petroleum products; one on lube side, one on cutting side, one to build up cutting oil diluted by lube oil.

TEST: Texaco Lube Engineer recommended dual-purpose Cleartex 140 for *both* cutting and lube sides of 25%" Conamatic for thirty day trial.

RESULTS: better finish, improved tool life, no dilution of cutting oil. Company switched *all 30 automatics* to Cleartex. After 6 months, no addition of base oil needed!

Company B: a well-known maker of cable (name on request).

Job: machining 303 Stainless brake cable nipple.

Had been using: three products—lube oil, cutting oil and base oil.

TEST: Texaco Lube Engineer recommended Cleartex 140 for *both* cutting and lube sides of 156" six spindle Greenlee.

RESULTS: after two weeks, company began gradual switchover of all 22 automatics to Cleartex! Got better tool life, improved finish on wide variety of steels, stainless and brass! Six months later—no compounding needed, even after tapping tough stainless!

A Texaco Lubrication Engineer will help you select the Cleartex grade which can give you similar results on your automatics. Just call the nearest of the more than 2,300 Texaco Distributing Plants, or write:

Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

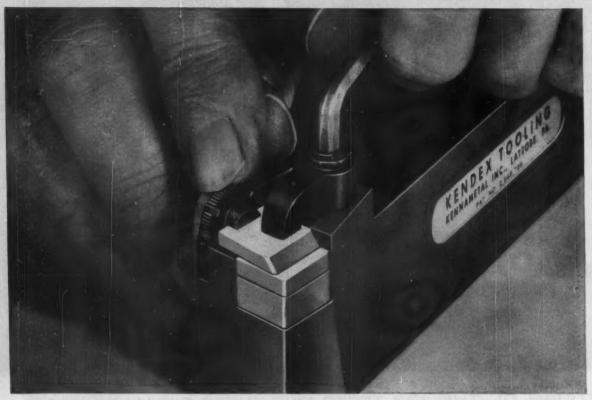


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SEE NEW KENNAMETAL



Easy adjustment, regardless of tool position. Just release the clamp and "dial" the breaker to any position desired.

NEW KENDEX DIAL-A-BREAKER

Easily adjustable...attached chipbreaker

Quickly, easily . . . set the chipbreaker where you want it, regardless of holder position. The new Kendex Dial-A-Breaker eliminates fumbling and fussing while changing and adjusting chipbreakers and inserts. Chipbreaker is brazed to its adjustment screw. It can't fall out, and the breaker setting is retained while indexing or changing inserts.

You no longer need a different breaker for every cutting job. Just turn the dial and position one chipbreaker for several jobs. Minimum of parts to stock . . . only two chipbreakers required for 70 styles and sizes of holders.

Kendex Dial-A-Breaker Tool Holders have the same basic design and accommodate the same solid Kennametal shims and "throw-away" inserts as used in standard Kendex holders. They are available in positive or negative rake, and with square or triangular inserts.

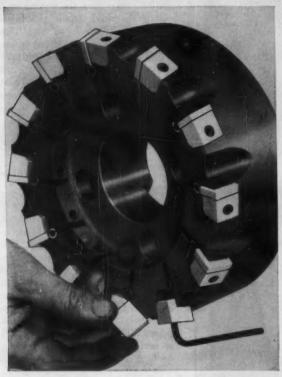


Holders with clamps and chipbreakers removed to show positive seating of both triangular and square inserts. Tool can be used without chipbreaker if desired.



All adjustments, chipbreaker and insert, can be made from the top of the holder. Permits close ganging of tools. (Clamp screw is also accessible from the bottom of tool when mounted in an inverted position on the rear carriage.)

TOOLING AT CHICAGO SHOWS



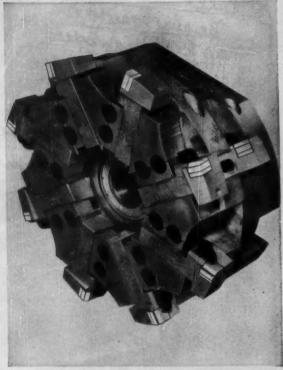
Retracting the wedge, by means of a double-end screw, quickly releases the inserts. Held in by the screw, the wedge cannot fall out, regardless of the cutter body position.



uses "throw-away" inserts

No grinding, no blade resetting! Each ¾-inch square Kennametal insert provides eight separate cutting edges. When one edge becomes dull, the clamp is released and the insert given a quarter turn to a new, sharp edge. It is then reclamped, without need to reset or gage the tool. When all eight edges (four on each side) have been used, the insert is replaced by a new one.

With a heavy cutter body . . . and more than %-inch of solid Kennametal backing up each insert . . . new Kendex Milling Cutters are built for the rugged service necessary for fast metal removal. The one-piece cutter body is made of heat treated steel. A 15-degree corner angle minimizes pressure on the workpiece. Solid Kennametal wedges and seats provide close-tolerance, positive positioning of the insert . . . to permit maximum utilization of available power.



Multiple insert Kendex head enables a major automobile manufacturer to bore and chamfer brake drums in one pass. Cutting edges can be indexed in a few minutes.

SPECIAL KENDEX "DESIGN-AND-BUILD" SERVICE

combines 2 or more operations in 1 pass

When "standard" tooling won't do the job . . . we will design and build tooling that will . . . such as special Boring Bars, Boring Heads, Multiple Tool Block Tooling, Hollow-Mill Tooling. Some examples of these Kennametal "specials" will be on display at the Chicago Shows.

SEE US IN CHICAGO

MACHINE TOOL BUILDERS SHOW
International Amphitheater—North Hall
Second Floor—Booth 1500—Adjacent to Restaurant

PRODUCTION ENGINEERING SHOW
Navy Pier · Booth 111

SEPTEMBER 6-16



KENNAMETAL
... Partners in Progress



assembly operations, their small size and adjustable spindles especially advantageous. Fastening holes in the base are spaced to fit aircraft and electronic peg-board assembly fixtures. Both models are furnished with neoprene-tipped spindles and stainless-steel pivot pins to assure long wear and smooth operation. Cadmium plating provides a tough, rust-proof finish.

Circle 593 on Readers' Service Card

Subminiature Electrohydraulic Servovalve

Miniaturized, high-performance electrohydraulic Series 30 servovalve, weighing only 5.12 ounces, announced by MOOG Servocontrols, Inc., East Aurora, N. Y. This valve features the same nozzleflapper hydraulic amplifier and mechanical feedback arrangement utilized in the Series 31 servovalves. Its principles of operation are also identical. However, the Series 30 servovalve uses a small second-stage spool and bushing contained in a lightweight aluminum body. The valve's maximum flow capacity is 3 gpm at 3000 psi which is adequate for most lowflow control systems. In spite of their small size, these servovalves are usually provided with standard mounting details, allowing them to be used interchangeably with servovalves on existing sys-



tems and test equipment. For new applications, Series 30 servovalve can be provided with smaller mounting feet, reducing its weight. Location and arrangement of the small feet permit drilling and tapping of existing manifolds to accommodate the smaller valve.

Circle 594 on Readers' Service Card

(Continued on page 236)



There's a WESPO clamp or plier for



80 models and sizes...

made better three ways to give more positive holding, last longer!

send for free catalogs describing Wespo clamps and fixture details

- 1 Reamed holes
- 2 Hardened serrated bushings
- 3 High tensile strength rivets

WESPO DIVISION

VLIER ENGINEERING CORPORATION Formerly West Point Manutacturing Company 26935 W. Seven Mile Road • Detroit 19, Michigan

Ther-Monic Unit for Internal Hardening of Trunnion Bearings

The bore and the bottom of the inside of trunnion bearings can be hardened at the rate of one every 6.8 seconds through the use of a Ther-Monic unit. This equipment was designed and built by the Induction Heating Corporation, Brooklyn, N. Y., for the Saco Lowell Automotive Division. The unit has a rotating work station with eight spindles which also rotate during the heating and quenching cycle. The operator merely loads the parts on the spindles and presses a button that starts the automatic cycle. As the station rotates, each spindle in turn is precision fixed beneath an air-operated coil, which is then automatically lowered into the fixture. The hardening process maintains a 0.0015-inch tolerance throughout the bore.

When the heating and quenching cycle has been completed, the bearing moves along on the rotating table, is automatically ejected onto a chute, and drops

into a tote box. Only the loading of the bearings is performed manually. The power source is a 25kw Ther-Monic generator and the fixture has complete operating controls for both the generator and the work station.

Circle 595 on Readers' Service Card

Rotary Tables Developed for Missile Guidance

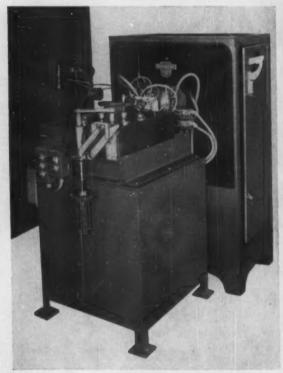
Precision rotary tables now being produced by the Pratt & Whitney Co., Inc., West Hartford, Conn., for the Arma Division, American Bosch Arma Corporation, are reported to be capable of indexing from any point in 360 degrees to any other point with an accuracy of plus or minus 1.5 seconds of arc. Believed to be the most accurate nonoptical rotary tables ever manufactured. these devices were specifically developed by Pratt & Whitney for use as azimuth indicators in missile-aiming systems. In this application, the tables will be equipped with optical devices and used to measure exact angular bearing from Polaris, the North Star.

In addition to their extreme accuracy, these rotary tables also feature digital read-out, which is said to insure unusual speed, ease, and dependability of operation.

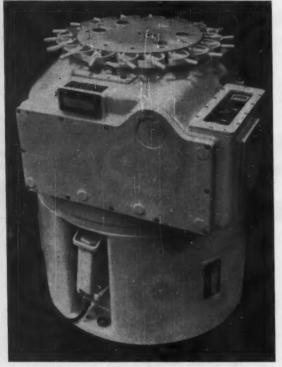
Degrees, minutes, and seconds are read directly on counter type indicators. There are no optical scales or verniers, and errors due to individual interpretations are eliminated. A dual set of counters is employed and is engineered so that windows never show half-turned numbers as counters go through the transfer stage.

The zero point for these rotary tables can be set at any desired location within 360 degrees. This is done in either of two ways: by maintaining an existing reading and rotating the table to the position desired, or by maintaining a desired table position and moving the counter reading to zero. To insure positioning accuracy, warning lights operate if correct procedures to remove backlash have not been followed.

Circle 596 on Readers' Service Card (This section continued on page 240)



Automatic Ther-Monic hardening unit built by the Induction Heating Corporation



Pratt & Whitney rotary table capable of extremely accurate indexing

See these 'Buffalo' Production-Boosters IN ACTION at the Machine Tool Exposition...Booth 551

NEW HOLLOW SPINDLE DRILLING MA-CHINES HANDLE FORMERLY "IMPOSSIBLE"

JOBS! RPMster's famous variable speed drive plus NEW hollow spindle for drilling "exotic" metals!

Read These Amazing Test Results:

316 Stainless Steel

Tool Steel Shear Blades Hardened to 54 Rc.

½" drill — 800 rpm .001" feed — 2½" through.

Rene 41

½" hole @ 750 rpm .001" — 3" through

Beryllium Bronze

1/2" hole @ 6200 rpm hand feed through 21/2" in 11/2 seconds.

Titanium

3/4" hole @ 1000 rpm .002" feed.

Cast Iron

¾" hole @ 2000 rpm .004" feed.

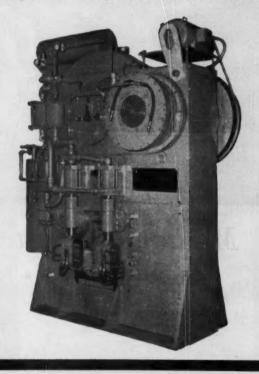
52-100 Alloy Steel

%" hole @ 800 rpm .001" feed.

NEW! FAST! 'BUFFALO' 400 BILLET SHEAR. Up to 18,000 cuts per 8-hr. shift . . . that's Real production! Makes clean, square cuts!

SPECIFICATIONS:

Ram tonnage	ons
Strokes per minute (free running)	00
Round Billets, mild steel 4 1/2" of	na.
Square Billets, mild steel 4"	sq.
Flat bars 12" x	2"
Knife size 3" x 7½" x	13"
Motor horsepower 20 HP Norr	nal
Maximum round or	
square size without modification 5" sq. or row	and
Machine stroke	2"
Machine, net weight 32,000	lbs.
Length x Width x Height 801/2" x 52" x 116	1/2"



There'll be action a-plenty at Booth 551, Machine Tool Exposition! Besides these two **new** 'Buffalo' units, you'll see demonstrations of other Quality-Built 'Buffalo' Machine Tools: the No. 18 Hollow Spindle Drill, the famous Universal Iron Worker that does seven different

jobs on one machine, and one of our line of improved Bending Rolls.

We'll be looking for you at the show! (If you can't wait for the MTE for full facts on these machines, contact your 'Buffalo' representative . . . or write us direct.)



MACHINE TOOL DIVISION BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.



Equipment to move, heat, cool, dehumidit and clean air and other gases.



'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.



'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.



to process sugar cane, coffee and rice. Special processing machinery for chemicals.

SEE IT AT CHICAGO



Modumatic Systems Control-Display
MEASUREMENT • POSITION • INSPECTION



Norden Division of United Aircraft Corporation presents advanced but simple systems applicable to your need for faster, more accurate positioning of tool or workpiece

Norden Modumatic Systems feature readout of actual position, automatic positioning, full range origin select, and controlled programing

FOR MEASUREMENT

Series 100—This system displays in straight decimal form the exact position of the tool or workpiece. One display is used for each axis of motion.

Features—Illuminated numbers, readable from twenty feet—individual plug-in decimal units—display unit can be located on machine or remote

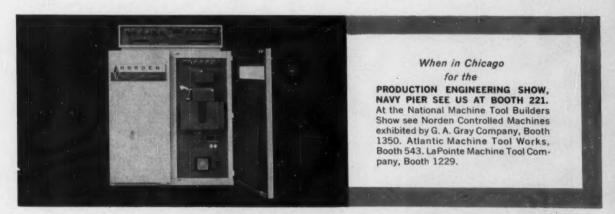
FOR POSITIONING

Series 600—A completely automatic positioning system with input from either manual dial-in switches or punched tape. Display units provide decimal readout of actual position—not command.

FOR INSPECTION

This new Norden concept now makes possible automatic inspection of parts by measuring their exact shape and contour. Since each point on the part's surface has a digital value this information can be easily programmed. Corresponding points on the actual part can be probed automatically and their dimensions compared with the programmed information. The system can be provided with direct numeric print or readout of actual dimensions, deviations from nominal, or out of tolerance indications. In addition, punched tape output is available.

Norden numerical control systems also offer full range electronic origin select. This allows any desired offset to be quickly and easily dialed in by the operator on manual selector switches. In addition, these systems are available with automatic tape punch units for tape preparation "on the machine." This provides a permanent inspection record or a programmed tape for playback applications.



For more information contact your nearest Norden Representative. 400 Main Street, E. Hartford, Connecticut, JAckson 8-4811. 11 West Monument Avenue, Dayton 2, Ohio, BAldwin 8-4481, or write us at the address below.

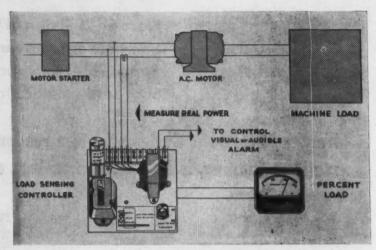
OF UNITED AIRCRAFT CORPORATION DATA SYSTEMS DEPARTMENT

SANTA ANA, CALIFORNIA

Real-Load Controller

A motor-load controller manufactured by Seneca Falls Machine Co., Seneca Falls, N. Y., senses the real load in kilowatts. This equipment, shown diagrammatically in the illustration, can be used with any machine driven by an alternating-current induction motor. It will operate with single- or three-phase systems at 110, 220, or 440 volts, sense voltage and current values, and measure phase angle.

In operation, it continuously measures the real load on a drive motor, actuates a visible or audible alarm, or shuts down the machine to prevent damage. The load can become too great due to malfunction caused by tool breakage on a metalworking machine. The alarm or shutoff relay can be adjusted to the desired overload percentage. Fixed loads, such as normal friction in a drive member, can be



Load control system available from Seneca Falls Machine Co.

balanced out if desired, so that the controller will only sense loads that exceed a fixed level.

Circle 597 on Readers' Service Card

Norton Miniature Precision-Mounted Grinding Wheels

A line of miniature precisionmounted grinding wheels, commercially available and known as "Minigrind," has been developed by the Norton Co., Worcester, Mass. These abrasive wheels, small as 0.036 inch in diameter, thin as 0.016 inch, were developed for use in miniature precision bearing manufacture. But additional uses for these miniature wheels are being found in the tool and die industry, specifically on jig grinders.

The manufacture of Minigrind wheels presented many difficult problems. Entirely new mixing, molding, and mounting techniques had to be developed. These tiny mounted wheels are so thin that the wall thickness is only the width of a few abrasive grains. Special mixing procedures had to be developed to insure a uniform and thorough coating of bond on each abrasive grain.

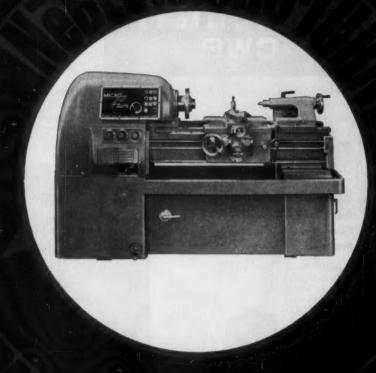
New mounting methods were devised to fasten the fired abrasive section to the needle-thin, stainless-steel precision mandrels. Unlike most conventional mounted wheels, Minigrind wheels required the mandrel's mounting end to extend through and support the entire length of the abrasive section. Because of their extremely small diameters, these wheels rotate at extremely high speeds to insure proper grinding action. Even at 100,000 to 150,000 revolutions per minute of the ultra-high-speed wheel spindles, the surface speed of the wheel may be as low as 1000 feet per minute. Normal grinding speed for conventional grinding is about 6500 sfpm.

Inspection of these mounted miniature wheels requires special microscopic equipment (shown in the illustration) to measure runout,

(Continued on page 244)



Norton Minigrind mounted wheels require special manufacturing and inspection techniques to meet accuracy requirement of the miniature bearing industry



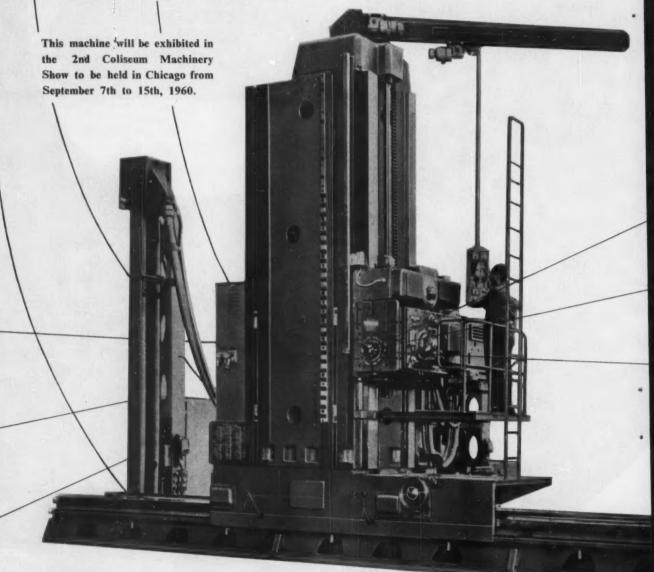
VISIT BOOTH 1319 DONOVAN HALL - 1960 MACHINE TOOL EXPOSITION
Ohio · Lathe builders since 186



MITSUBISHI INNOCENTI CWB

milling boring

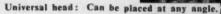
MITSUBISHI ZOSEN KABUSHIKI KAISHA (Mitsubishi Shipbuilding & Engineering Co., Ltd.) take pleasure in announcing the conclusion of a license agreement with INNOCENTI S.G. of Milano for the manufacture and world-wide distribution of the universally known INNOCENTI-CWB MILLING, BORING & COMBINED MACHINES. The machines will be produced in Floor Type, Planer Type and other Combination Types, the diameters of spindles being 140 mm for milling and 95 mm for boring.



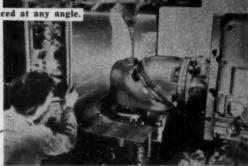
Sales Agents:

- New York: Mitsubishi International Corp., 120 Broadway, New York 5, N.Y.
- Les Angeles : Mitsubishi International Corp., Los Angeles Branch, 606 South Hill St., Los Angeles 14, Calif.
- Chicago: Chicago Representative of Mitsubishi International Corp., Room 1803, Prudential Bidg., 130 East Randolph Drive, Chicago, III.
- Vancouver: Mitsubishi Shoji Kaisha, Ltd., Vancouver Branch, 210 Taranto Dominion Bank Bldg., 717 West Pender St., Vancouver 1, B.C.
- Lendon: Mitsubishi Shoji Kaisha, Ltd., London Branch, 104/106 Leadenhall St., London, E.C. 3
- Paris: Paris Liaison Representative of Mitsubishi Shoji Kaisha, Ltd., c/o Mr. G. Bauvet, 5, Rue Boudreau, Paris 9
- Duesseldorf: Deutsche Mitsubishi Export & Import-Gesellshaft m.b.H., 12 Grunstrasse, Duesseldorf
- Melbourne: Mitsubishi (Australia) Pty., Ltd., Melbourne Office, 1st Floor, Houghton House, 543 Little Collins St., Melbourne, C. 1, Victoria

and combined machines



Milling can be done on three faces by the three way head.

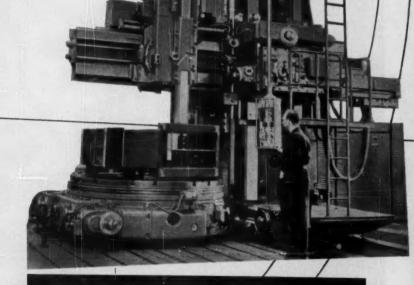


Right-angle head: Can be swivelled 360°.

When fitted with a rotary table and a removable arm, it can be used as a turning lathe.



Grooves are machined by the turbine head.



MITSUBISHI ZOSEN

Head Office: Marunouchi, Tokyo, Japan Machine Tool Manufacturing Division:

HIROSHIMA PRECISION MACHINE WORKS

Hiroshima, Japan

concentricity and other factors affecting quality. Even new packaging methods had to be developed to protect the wheels in transit and storage.

Typical specifications of these small wheels are A320-TVM for bore grinding, and A320-MVG, No. 22 treated for ball-race grinding. The No. 22 treatment gives a better finish and longer wheel life. The correct wheel specification for a specific job depends upon the material to be ground; its hardness, size, and stock removal.

Circle 598 on Readers' Service Card

Transfer Machine Designed for Automotive Part

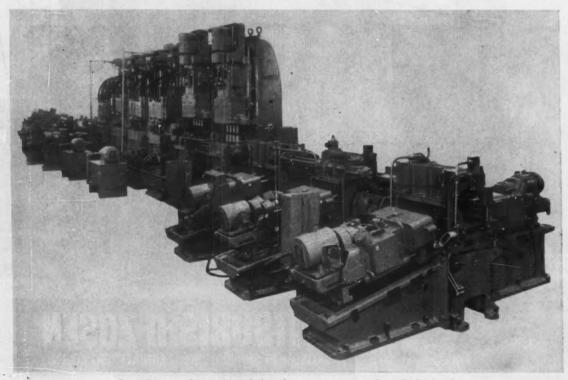
A twenty-two-station transfer machine with eighty-one spindles has been built by the Foote-Burt Co., Cleveland, Ohio, for machining automotive cylinder heads. It performs drilling, gun drilling and boring, tapping, and spot-facing operations. Production is 130 parts an hour at 100 per cent efficiency. Gun-drilling spindles drill and bore the valve-guide holes. (In gun drilling, hollow drills are used with high-pressure coolant delivered to the cutting area through the hollow drill.) Gun drilling and gun boring are done at four stations. Two pump units are used; each supplies two stations with highpressure (25 psi) coolant. The pumps are powered by 10-hp drive motors.

The spindles at the gun drilling and boring stations are equipped with ball bearings which have microfog lubrication. Each of the gun-drilling spindles is mounted inside another spindle which has a separate feed and speed. Cutters mounted on the outer spindles bore and surface the valve-seats. All of the machining heads are mounted on cylindrical ways, an exclusive Footburt feature. Because the bars are round, chips cannot pile up and get caught under the machine head and mar the ways or cause them to wear. The round shape makes the ways inherently self-cleaning.

All drilling, boring, and spotfacing spindles have hydraulic feed. The tapping spindles are equipped with lead-screws. Spray lubrication is provided for all taps. The main head has splined spindles and driving studs. Engineering changes in the cylinder head will not make the machine obsolete. Only the geared drill heads need be replaced to take care of changes in part design. The machine is designed throughout to use standardized components. Thus, it avoids the obsolescence factor normally associated with transfer machines, yet retains all the advantages inherent in such machines for long production runs.

Chips and coolant drop through to an under-the-floor conveyor. There is a work roll-over unit at the exit end. The electrical circuitry of the machine is set up so that three stations can be bypassed for running service parts. A probe station located just before the tapping station makes sure that there are no broken drill ends in the holes. The machine has an automatic pressurized lubrication system. All spindles have either ball or roller bearings. Work comes to the machine from a conveyor line.

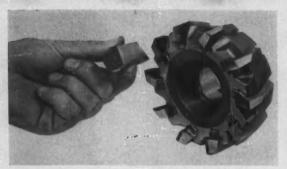
Circle 599 on Readers' Service Card (This section continued on page 246)



Foote-Burt transfer machine designed to process automotive cylinder heads



JACOBS MANUFACTURING COMPANY . WEST HARTFORD, CONNECTICUT



Rigidcut face-milling cutter with brazed carbide blades



Unique Econo-Bore counterbore with replaceable blades

Wesson Carbide Milling-Cutter Blades

A new milling-cutter blade design, Series 7888, is said to increase blade life by an average of 36 per cent. It can be reground many more times than the blade it replaces, claims the Wesson Co., Detroit, Mich. The new blades are used in milling cutters for machining cast iron, aluminum, magnesium, and steel. When blades are no longer useful, less carbide is scrapped. Seventeen 0.030-inch regrinds are possible on each new blade, whereas only twelve are possible with old blades.

Series 7888 blades will be supplied on all new Scries 5200, 5400, and 5500 milling cutters and can be used on old cutters. They are made for right- or left-hand cutters 4 to 32 inches in diameter.

Circle 600 on Readers' Service Card

DoALL Counterbore with Replaceable Blades

A counterbore recently developed by the DoALL Co., Des Plaines, Ill., has high-speed steel blades which can be replaced at a nominal cost, regardless of size. This places them in the throwaway class, even though they can be easily resharpened to special sizes. Named "Econo-Bore," the blades are also interchangeable so that blades of the same thickness may be used with different shanks and pilots. Because of this feature,

it is possible to make more than thirty different combinations of sizes with the Econo-Bore set. It has five shafts which serve as both shank and pilot, ten blades, and two extra pilots. Screw sizes covered in the set are No. 10, 1/4-, 5/16-, 3/8-, 1/2-, 5/8- and 3/4-inch. Pilots and blades are 1/32-inch oversize to allow for clearance; they also may be used for spot-facing. Econo-Bores are recommended for toolroom or light production work. Twenty-four blade sizes are available.

Circle 601 on Readers' Service Card

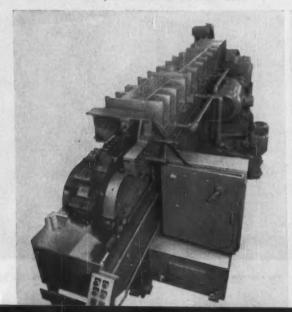
Twenty-Ton Continuous Broaching Machine

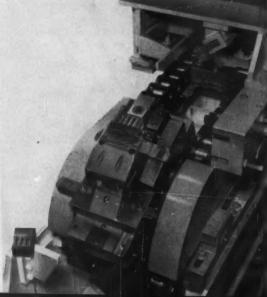
Continuous horizontal broaching machines capable of high production are being built by the Detroit Broach & Machine Co., Rochester, Mich. These machines

utilize a powerful twin-chain drive to pull work-holding fixtures through a tunnel equipped with a series of broach cutting tools. Broaching is done in one pass

Fig. 1. Continuous horizontal broaching machine placed on the market by the Detroit Broach & Machine Co.

Fig. 2. Close-up of loading station of machine seen in Fig. 1, with work-piece shown in lower left corner





ANNOUNCING

NEW GISHOLT 3F FASTERMATIC WITH

> **feeDial** CONTROL



GISHOLT

DIAL YOUR FEEDS



LICK YOUR SPEED



MINUTES! N JUST 15

...then set your tools and take your trial cuts. That's how fast and simple it is to set up the new Gisholt MASTERLINE 3F FASTERMATIC **Automatic Chucking Turret Lathe!**

Only 15 minutes to pre-select feeds, speeds and functions-Now the desired feed rate is individually selected for each tooling station by turning a dial control. Selection of spindle speeds and machine functions is equally fast-just flick toggle switches. You do it all in just 15 minutes.

Send for literature—Ask your Gisholt



consistent quality at fixed production rates. Any operator, even a new man, can chuck the work, start the cycle and remove the finished part. He has ample time to handle another machine. What's more fast setup makes the new 3F pay off

Completely automatic-But your savings don't end with fast setup. The automatic cycle assures

big on machining small lots-25 to 50 pieces-as well as long production runs. Contact your Gisholt Representative, or write us.

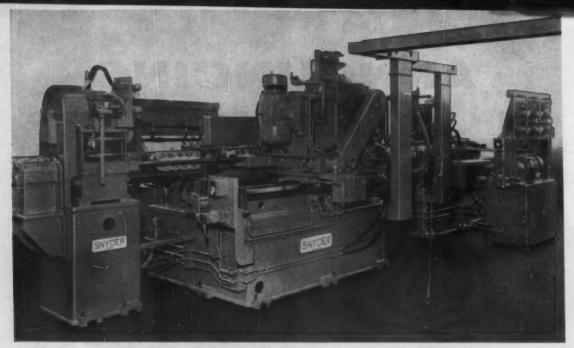
Representative to show you how this new 3F with FeeDial can cut costs on your work.





Turret Lathes . Automatic Lathes

Balancers • Superfinishers • Threading Lathes · Factory-Rebuilt Machines with New-Machine Guarantee Investigate Gisholt's Extended **Payment and Leasing Plans**



Snyder special eight-station transfer machine for processing cylinder heads

through the machine, and any flat or irregular surfaces which are parallel to each other can be machined. Angular surfaces can be broached through the use of fixtures arranged to tilt or index at the proper point.

The 20-ton machine with a 144inch stroke, shown in Fig. 1, was designed to perform two separate broaching operations in a single pass on a manual steering-gear ball nut for a European automobile. Production of 182 pieces per hour is obtained from nine fixtures running at 13.6 fpm. Increased production is obtainable by adding fixtures to a maximum of eighteen and/or increasing machine speed through a change-gear arrangement. The machine is powered by a 40-hp, 50-cycle motor having a speed of 750 rpm.

The operator feeds each part into a work-holding fixture on the endless chain. Fixture locking, broaching, and unloading are automatic. Broaches inside the tunnel, amply supplied with pressurized coolant, broach the top of the ball-nut rack teeth. A slidebar and cam act to tilt each fixture to permit precision broaching of the rack teeth from the solid.

Surface finish tolerances of the completed work range from 18 to 25 micro-inches on all broached surfaces. Safety features protect machine and parts from damage.

Circle 602 on Readers' Service Card

Special Transfer Machine for Rough-Milling Aluminum Cylinder Heads

An eight-station, 24-foot long special transfer machine that rough-mills the cover face, exhaust bosses, construction bosses, joint face, and intake face of aluminum automotive-engine cylinder heads at a rate of 120 pieces per hour has been built by the Snyder Corporation, Detroit, Mich. The machining of aluminum requires the spindles to operate at a cutting speed of 5000 sfpm. Hollow spindles provide coolant to cutting edges. Recirculating oil systems in the special milling head reduce size of head and cool bearings.

The machine consists of four segments: two machining units and two part-orienting units. The rough-cast cylinder heads are received from the factory conveyor line and are moved through the transfer machine by a rotating finger transfer mechanism. To avoid marking the machined faces of cylinder heads by returning the cutters over the finished surfaces, the milling heads are fed in a direction opposite to that of the work travel. Thus, when a part has been milled, the cutter remains at the rear of the work. Then during the transfer of the work to the next station, the cutter returns to the starting position behind the finished part.

Each milling segment has two

stations. A part is held ready for milling in the first station while one is clamped and milled in the next station. The milling unit is carried on slides which are mounted on a one-piece welded base. To make certain that the head is correctly clamped, air holes in rest buttons have to be sealed before milling starts.

The operating sequence is as follows: a part is transferred from the first station in milling segment one to the second station, where it is clamped. In this station a three-spindle head mills the cover face, exhaust bosses, and construction bosses in three different planes. From Station 3, the part is transferred to Station 4, where it is automatically rotated 90 degrees. The part then goes through Station 5 to Station 6, where it is clamped for the milling of the joint face and intake face by a two-spindle head having cutters at right angles to each other. At Station 8, the part is rotated 180 degrees.

The electrically controlled, hydraulically operated machine has two hydraulic power packs. The milling head in the first segment has 5-7 1/2- and 10-hp motors. The milling head in the third segment has 10- and 25-hp motors.

Circle 603 on Readers' Service Card (This section continued on page 250)

INNOCENTI

MECHANICAL DIVISION

head office:

offices and factory

Via Pitteri 81 - tel. 23-93 centralino

MECCANICA

METALLURGICA

L'INDUSTRIA

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Via Parigi 11 - tel. 487.051

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our technique at the world's service



INNOCENTI

Steel work equipments

Large electrical furnaces for steel making Manipulators for Martin furnaces

Forging presses

Continuous casting of steel and non-ferrous materials Ingot hot peeling machines

> Complete rolling mills for blooms and slabs Rolling mills for billets, rails, bars and shapes

> > Sendzimir hot planetary mills for strips

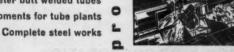
Medium and small rolling mills for plates, strips, shapes, bars, round bars and wire rod

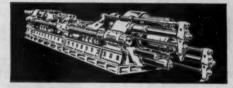
Sendzimir cold rolling mills for strips

Continuous mills for cold rolling of large strips and plates

Pickling and shearing lines Rolling mills for seamless steel tubes

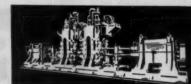
Plants for production of large diameter butt welded tubes Auxiliary equipments for tube plants









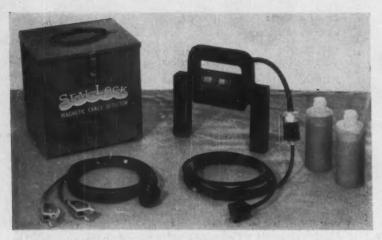






Machine-Tools

Large, high-powered milling and boring machines Presses for hot and cold drawing.



Unit for Detecting Subsurface Cracks

Model S-20 portable Seal-Lock magnetic crack detector, announced by the United States Casting Repair Corporation, Philadelphia, Pa. This unit (patent pending) is capable of detecting subsurface, as well as surface, cracks, flaws, and defects in any ferromagnetic metal. In laboratory and field tests, the unit has instantly detected defects in steel bars as deep as 1/2 inch below the surface. It can be operated from a normal 110-volt alternating-current source or from an ordinary truck or auto battery. In addition, units are available for operation from any other alternating- or direct-current voltage source.

Circle 604 on Readers' Service Card

Peer High-Production Butt Welder

Automatic, air-actuated, precision butt welder designed for speed and stamina, brought out by Peer, Inc., Benton Harbor, Mich. Thi. Model B10 heavy-duty equipment is easy to set up and operate. It is designed to maintain precision alignment of the parts being welded. The clamping jaws are actuated by individual air cylinders to assure positive clamping action at all times. Upset pressure is also air-operated by a third independent air cylinder with complete control of both the upsetting pressure and degree of upset. A novel, noncritical built-in automatic welding actuator eliminates the critical air-pressure switches



previously used. It is only necessary to set the jaw clamps for the thickness of material being welded, set the current control switch for the degree of heat required, and start welding.

Circle 605 on Readers' Service Card

Pillow Block with Easily Replaced Liner

Bronze precision liners can be replaced quickly and easily in pillow blocks of this new design announced by the Dodge Mfg. Cor-



HOW TO DESIGN EXCESS WEAR OUT OF MACHINE TOOLS WITH MADISON-KIPP Fresh Oil Lubricators

Machine Tools, Compressors and special machines of all kinds have been kept in top condition for 20 or 30 years or more when equipped with one of 6 models of Madison-Kipp Lubricators.

Fresh Oil Lubrication is automatic, closely measured, constantly fed new oil under pressure for each friction surface to which it is applied.



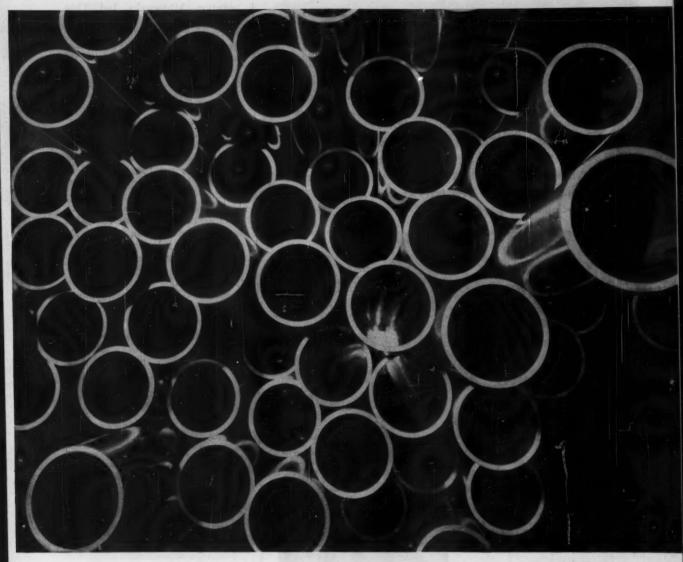
The Model OL—one of the 6 Models of Modison-Kipp Lubricators.



MADISON-KIPP CORPORATION 203 WAUBESA STREET . MADISON 10, WISCONSIN

Skilled in Die Casting Mechanics . Experienced in Lubrication Engineering . Originators of Really High Speed Air Tools





Look at the dimensional accuracy and smoothness

You can reduce the costs and processing time of parts-making by using USS National Electric-Resistance Welded Mechanical Tubing. It eliminates drilling operations. It lets you replace drills with simple, less expensive boring tools. Mechanical Tubing reduces tool wear and tool changes.

USS National Electric Welded Mechanical Tubing is an ideal load-carrying member. It resists bending stresses equally in all directions and gives you a superior cross section. It absorbs and localizes shock. In torsion, it provides better material distribution. And for a given weight, mechanical tubing withstands more load than other sections.

USS National Electric Welded Mechanical

Tubing is available in cold-drawn or hot-rolled sizes 3%" thru 5½" and in wall thicknesses .035" to .250". It can be obtained from National Tube Distributors located throughout the country. They will gladly show you how to use USS National Welded Mechanical Tubing in your next application. See your USS National Tube Distributor.

USS and National are registered trademarks



National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors United Status Steel Supply Division United States Steel Export Company, New York

MACHINERY, August, 1960

For more data circle this page number on eard at back of book

WHY MICROHONING OF HARDENED LINERS

cuts production time two-thirds

One of the largest steel corporations utilizes Microhoning's rapid stock-removal in the processing of oil well slush pump liners. Bore diameters ranging from 4.50" to 7.75" and up to 28" long are lined with a special alloy steel hardened to 64-66 Rockwell "C". Over one cubic inch of stock per minute is removed from bores of these liners to reduce required production time by two-thirds.



This heavy-duty Hydrohoner has a 4-foot hydraulic head stroke, an 8-speed transmission, a special heavy-duty feed mechanism and automatic stonewear compensation.

One heavy-duty horizontal Hydrohoner has eliminated the use of bore grinding (two grinders), and replaced two old vertical honing machines. Requiring only one operator, the Hydrohoner does the complete bore machining operation in one-third the previous time. Also, during the automatic rough-Microhoning cycle, the operator is free for an average of 20 minutes to work on an adjacent machine, where the liner O.D. is machined concentric to the Microhoned bore.

Two Microhoning operations are performed (rough and finish) to provide final bore roundness and straightness within .0005" and surface finish of 6-8 microinches (rms). An extremely hard surface having geometric accuracy and controlled finish lasts longer, provides better performance — that's why Microhoning is specified for processing these oil well slush pump liners.



Shown are rough-Microhoned and finish-Microhoned bores. Following each Microhoning operation every bore is given a close inspection under the revealing probe of a fluorescent light to insure a flawless surface.

See facing page for details on how Microhoning of pump liner bores secured production time savings.

*Registered U.S. Pat. Off.



MICROMATIC HONE CORP.

poration, Mishawaka, Ind. This bearing is recommended for use where shock loads, elevated temperatures, and corrosive conditions are anticipated. It is designed to permit replacement of a worn bushing, or liner, without removing the bottom half of the housing from its support. Only the cap of the block is removed, the shaft being lifted just enough to permit the lower half of the liner to be loosened and slipped out. A new bronze liner can then be inserted and seated by tapping lightly. The cap liner can also be replaced very easily. No screws are required. Rotation of the liner with the shaft is prevented by a brass retainer spool recessed between the cap and base of the housing. The line includes split journal bearings (two-bolt) for standard power transmission shafts, rigid pillow blocks (four-bolt), and angle pillow blocks for standard shafts.

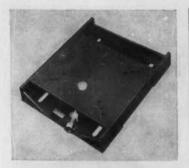
Circle 606 on Readers' Service Card



Allen Hex Keys

Sixteen Allen Hex keys in a compact, metal workbench stand, introduced by the Allen Mfg. Co., Hartford, Conn. These hex keys will fit practically all Allen hexsocket screws except the very large diameters. The keys range in size from 0.028 through 1/2 inch (hex width across flats). They are individually held upright in the stand and are identified by a keysize chart on the front of the stand. Included are the new 7/64and 9/64-inch sizes for Nos. 6 and 8 '60 series cap-screws in the Allen line. Spaces are provided for three large keys (9/16-, 5/8- and 3/4inch) not furnished with the set.

Circle 607 on Readers' Service Card



Pancake Motor Base

Sliding motor base of the low "pancake" type for use in variablespeed sheave installations where space is at a premium, announced by T. B. Wood's Sons Co., Chambersburg, Pa. There's a provision for rapid release of the adjusting screw. The base can be moved quickly and easily to shorten center-to-center distance and free Vbelts from the grooves for sheave adjustment. The height of this "Quick-Slide" base is only 1 9/16 or 1 21/32 inches, depending on the NEMA motor frame number. Amount of movement is either 4 1/2 or 6 inches.

Circle 608 on Readers' Service Card

Long-Life Switch for High-Speed Applications

Heavy-duty limit switch for ore bridge trolleys, slope hoists, and similar high-speed applications, developed by the EC&M Division of Square D Co., Cleveland, Ohio. This Type TH switch is suitable for applications where travel speed is as high as 1200 feet per minute. It features a forked operating lever made of a special high-impact-resisting plastic. Unlike steel, this material does not damage the operating bar. Its resilience also reduces shock to the interior parts of the switch, which can be used indoors or outdoors.

Circle 609 on Readers' Service Card



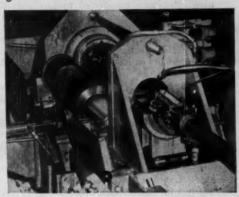
HOW MICROHONING OF HARDENED LINERS

cuts production time two-thirds

Microhoning eliminates bore grinding (two grinders), replaces two old vertical honing machines with one horizontal Hydrohoner, and performs all bore machining on this one Hydrohoner in one-third of the previous processing time. Here's how these unusual production results are obtained on oil well slush pump liners.

Two Microhoning operations (rough and finish) are performed on the bores of these hardened (64-66 Rockwell "C") liners. Bore diameters range from 4.50" to 7.75" and lengths are up to 28". The rough Microhoning removes approximately .090" of stock at an average clip of .0045" per minute and generates a 20 microinch (rms) finish.

Fixturing includes hydraulic end clamping to handle liners from 14" to 28" long. Adjustable hydraulic loader handles varying diameters. Heavyduty Micromold tooling allows the use of more abrasive for faster stock removal. One tool handles a range of bore diameters.



A new stonefeed assembly, capable of exerting a five-ton thrust, permits this stock-removal performance. When the Microhoning tool enters the bore, the abrasives are instantly expanded against the bore surface. As contact is made, a sensing device de-energizes the rapid feed and a pre-set regular feed rate controls further expansion. At the end of the automatically timed Microhoning cycle, the tool is instantly collapsed and withdraws from the bore.

Changeover from rough to finish Microhoning requires only the replacing of abrasives with finer-grit sticks and resetting of timer to shorter cycle—less than 90 seconds is needed for changeover. Finish

Microhoning time is about two minutes, roundness and straightness are held within .0005" variation throughout the length of bore, and surface finish of 6-8 microinches (rms) is generated.



Visit Us In Booth 1225—The Machine Tool Exposition



MICROMATIC HONE CORP.

Mews of the industry

California and Washington

AMERICAN ELECTRONICS, INC., Los Angeles, Calif., announces an expansion of the marketing organization for Auto-Cycle precision boring and turning machines. The machines are produced at Norwood, Mass., by the company's Industrial Machinery Division. Co-incident with the expansion program, PETER J. WALENT has been named customer relations manager. FRANK POREBER, previously at the Norwood, Mass., plant, has been transferred to Los Angeles. He has been appointed to the new post of manager, technical services, Western Area. In the same capacity for the Eastern Area, headquartered at Norwood, is ROBERT E. HAWKINS.

S. VAUGHAN ANDREWS has been named personnel manager of HUGHES ARCRAFT Co.'s El Segundo, Calif., manufacturing division. He succeeds ELMER F. SPROULE, who has been named head of management development and training on the industrial relations staff at the company's head-quarters in Culver City, Calif.

HUGH C. BREAM has been named president and general manager of Western Design, Goleta, Calif., a division of U. S. Industries, Inc. Previously, Mr. Bream was manager of



Hugh C. Bream, president and general manager of Western Design, a division of U. S. Industries, Inc.

Western Design's Santa Barbara division. He succeeds Mr. C. W. Sponsel who resigned recently to pursue personal business interests.

ROLAND HECKER has assumed the position of chief engineer of the Burg Tool Mrg. Co., Inc., in Gardena, Calif.

GARFIELD R. CRAWFORD of Seattle, Wash., has been named resident manager of sales, Pacific-Northwest Region, for the Jones & LAUGHLIN STEEL CORPORATION, Stainless and Strip Division. He will handle mill sales of division products from plants in Detroit, Mich., Youngstown, Ohio, Indianapolis, Ind., and Los Angeles, Calif.

RUCKER Co., manufacturer of hydraulic and pneumatic power and control equipment, announces the appointment of Alan Grant Huches as inside sales engineer at the company's Oakland, Calif., head-quarters office. In addition, Max C. Thompson has been appointed inside sales engineer in the company's Portland, Ore., office.



ONSRUD MACHINE WORKS, INC., Niles, Ill., announces the purchase of the Hydraulic Press Division of Berthelsen Engineering Works, Inc., Joliet, Ill. The newly acquired products line includes heated-platen, single- and multiple-opening presses for laminating plywood, reconstituted board products, metal, plastics, and rubber. Manufacturing, sales, and service will be carried out under the newly formed Onsrud Berthelsen Hydraulic Press Division. Key Berthelsen personnel are being retained.

HAROLD HAUCK has been appointed assistant sales manager in charge of railroad tooling by the VASCOLOY-RAMET CORPORATION of Waukegan, Ill.

VICTOR J. TAYLOR has been named a vice-president of the AMFORGE DI-VISION of American Brake Shoe Co.,



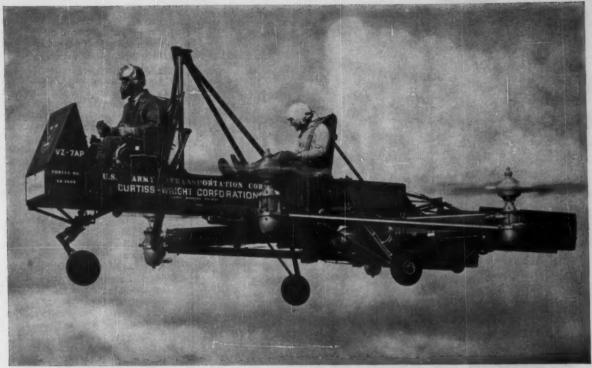
Victor J. Taylor, vice-president of the AmForge Division, American Brake Shoe Co.

Chicago, Ill. In his new position, Mr. Taylor will be responsible for Am-Forge's entire West Coast operation.

VASCOLOY-RAMET CORPORATION of Waukegan, Ill., has appointed ten new distributors to handle its complete line of V-R carbide and tantung cutting tools. They are AUGUSTA MILL SUPPLY Co., Augusta, Ga.; BLUE RIDGE HARDWARE & SUPPLY Co., Inc., Bassett, Va.; INDUSTRIAL SUPPLY Co., Coffeyville, Kan.; RALPH B. MOORE, INC., Denver, Colo.; RICHMOND SUPPLY CORPORA-TION, Richmond, Ind.; SHENANDOAH TOOL & SUPPLY Co., Salem, Va.; SINCLAIR INDUSTRIAL SUPPLY Co., Trenton, N. J.; SUMMERS HARDWARE & SUPPLY Co., Johnson City, Tenn.; TRIPLE MILL SUPPLY, INC., Jackson, Mich.; and VAN TASSEL TOOL Co., Hudson, N. Y.

ALCO PRODUCTS, INC. has opened a new \$500,000 production center for cold-wound springs. The new facility is housed in an 18,000-square-foot addition to the firm's plant at Chicago Heights, Ill., which has been a major producer of hotwound springs for many years. Cold-wound springs formerly were manufactured at Latrobe, Pa.

VICTOR FREDERIKSEN has been appointed works manager of Moto-Mower, Inc., a subsidiary of Dura



RESEARCH AERIAL PLATFORM will have high degree of civilian utility. Transmission system, whose component parts act as power units and structural members, employs 4340 and 4620 nickel alloy steels for shafts and gears.

Aerial platform's unique transmission system uses two nickel alloy steels-4340 and 4620

This experimental aircraft combines the maneuverability of a helicopter with the load-carrying capacity of a truck.

The platform is built around a unique transmission system whose components act as both power units and structural members. Designed jointly by Curtiss-Wright Corporation and Sargent Engineering Corporation, its builders, the platform uses a 400hp gas turbine engine to power four 2-blade propellers through a central gearbox arrangement.

For the gears, the designers specified carburized and hardened AISI Type 4620 nickel alloy steel in the central gearbox and in each of the propeller gearboxes. At every running speed, casehardened gears of 4620 alloy steel withstand friction and wear. What's more, 4620 gear cores are tough enough to absorb any sudden shock-loads that may occur during flight.

For the propeller shafts, the specifications called for AISI 4340 nickel alloy

steel, heat-treated to 30-35 Rockwell C. This versatile through-hardening steel provides exceptional toughness and fatigue strength, and is noted for its superior machinability at high hardness levels. In addition, AISI 4340 steel develops uniform hardness throughout parts of medium to heavy section, despite variations in section size.

The men who designed the aerial platform couldn't predict all the complex stresses these parts would encounter in operation. They selected 4340 and 4620 because these steels have proven their reliability and versatility during many years of service, under a variety of strenuous operating conditions.

Whether or not you, too, are experimenting, 4340 and 4620 offer you the same assurance of reliability... plus a way to cut costs by simplifying inventory. These steels are available right off the shelf at your local Steel Service Center. Other nickel-containing steels,



EXPANDED VIEW of central gearbox shows how 4620 nickel alloy steel gears fit into box and drive the four propellers.

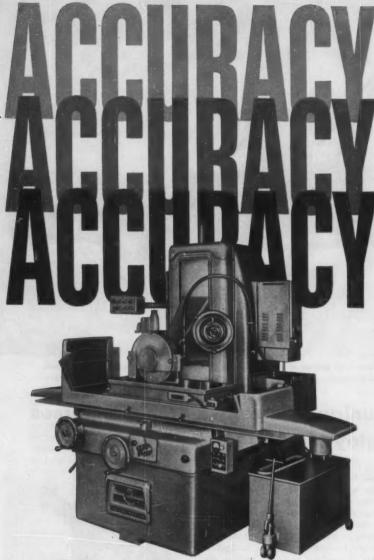
providing more specialized properties, are also widely available.

Consider nickel alloy steels for gears, shafts, bearings and other parts you design, order or use. And for information to help you select the right material for your application, just write us.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO NICKEL

NICKEL MAKES STEEL PERFORM BETTER LONGER



. . to millionths of an inch

Accuracy that's a must for tool rooms . . . so fine it can be measured only by a light bounce, so precise it produces microinch finishes at production speeds. This is the accuracy you get in the No. 560 Grand Rapids Precision Tool Room Type Hydraulic Feed Surface Grinder . . . accuracy assured by such features as hand-scraped V-shaped ways, rigid onepiece column and base casting, truly automatic cross feed and extra-heavy spindle. Why settle for less?

For information on the No. 560 or the Nos. 550, 360 and 350 Tool Room Type Surface Grinders, send a note on your letterhead.



Booth 751 The Machine **Tool Exposition**



GALLMEYER & LIVINGSTON CO. 305 Straight Ave., S.W.

Grand Rapids, Michigan

Corporation, Richmond, Ind., and a leading manufacturer of power lawn mowers and other powered lawn and garden tools.

GENERAL ELECTRIC Co. has filled two new positions in a realignment of the marketing section of their SPECIALTY TRANSFORMER DEPART-MENT, Fort Wayne, Ind. DONALD K. Moe has been named manager of electronic industries sales, and Don-ALD R. KEARNS has been appointed manager of product planning, marketing research, and marketing administration.

WILLIAM B. BOYD has been appointed manager of manufacturing for the SPECIALTY TRANSFORMER DEPARTMENT of the General Electric Co., Fort Wayne, Ind. Mr. Boyd succeeds J. RICHARD GARVIN who has been appointed manager of manufacturing for the company's SPE-CIALTY MOTOR DEPARTMENT, also in Fort Wayne.

Michigan and Wisconsin

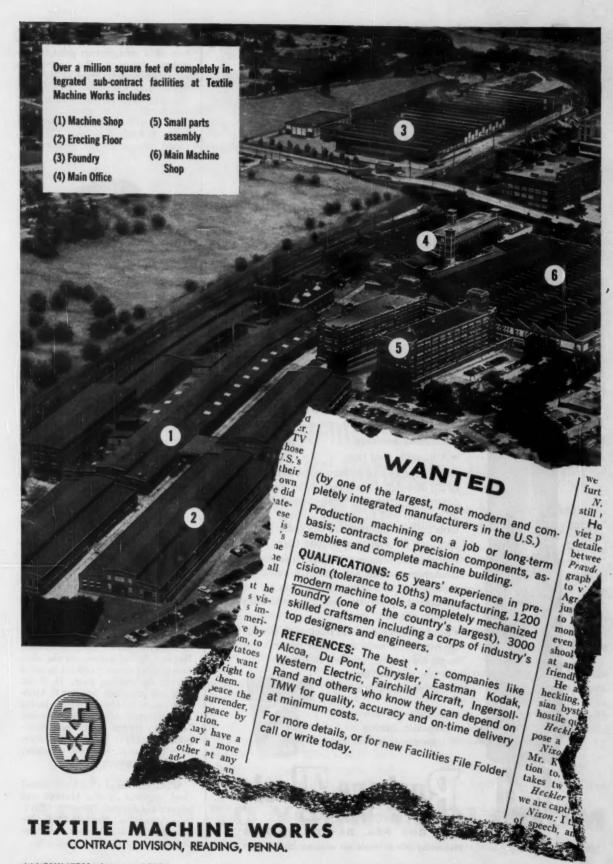
WALTER I. WEED has been appointed supervisor of quality control at the Detroit, Mich., plant of the Iones & Laughlin Steel Cor-PORATION, Stainless and Strip Division. Mr. Weed joined Jones & Laughlin in 1954 as a metallurgist.

HOWARD J. TOLL has been appointed personnel manager of the B-G-R Division of Associated Spring Corporation, Plymouth, Mich.

DUNCAN B. GARDINER has been appointed manager, corporate engineering, for VICKERS INCORPORATED. Detroit, Mich., a division of the Sperry Rand Corporation.



Duncan B. Gardiner, manager, corporate engineering for Vickers Incorporated





WHIRLPOOL CORPORATION, St. Joseph, Mich., announces the formation of a refrigeration products division, bringing the company's manufacturing facilities at St. Paul, Minn., and Evansville, Ind., under the administrative supervision of a vice-president, refrigeration products. Named to this new position is JOHN PLATTS. KENNETH C. WILLIAMS becomes general manager.



Robert L. Misener, assistant secretary of the National Broach & Machine Co.

ROBERT L. MISENER has been appointed assistant secretary of the NATIONAL BROACH & MACHINE Co., Detroit, Mich. Mr. Misener joined the company in 1953 as internal auditor, a position he will continue to hold in his new capacity.

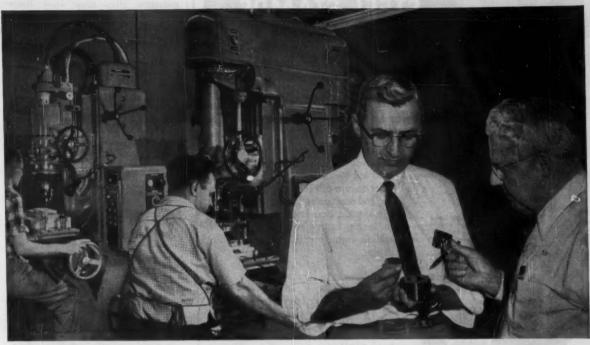
KARL F. KELLERMAN, former assistant to the vice-president of engineering, has been appointed assistant to the executive vice-president of the BENDIX CORPORATION, Detroit, Mich. Mr. Kellerman will assist management in the expansion of Bendix commercial and industrial activities at both the corporate and divisional levels.

Morton Mfc. Co., Muskegon Heights, Mich., announces the election of the following officers to serve during the coming year: H. EARL MORTON, president; ROBERT E. MORTON, executive vice-president; JAMES H. MORTON, vice-president—sales; JACK E. MORTON, vice-president—purchases; MATT H. MORTON, secretary; THOMAS H. MORTON, treasurer; and C. N. Sessions, director.

W. C. McDonald has been named chief engineer of the Marine and Industrial Engine Division, Chrysler Corporation, Detroit, Mich. He succeeds H. D. Peacock who resigned.

Pioneering Power Tools for Industry Since 1920

Herbert Harig, president, and Karl Harig, chairman, Harig Manufacturing Corporation, Chicago, examine tenth-splitting accuracy from their No. 3 Moore Jig Grinder (left) and No. 3 Moore Jig Borer.



"We're now splitting tenths, thanks to Moore's new No. 3 Jig Borer and Jig Grinder"

"Our operators feel these are the best machines they have ever worked on...
They take care of the tenth-splitting tolerances required by industry today."

No. 3 Moore
Jig Grinder

No. 3 Moore
Jig Borer

Made and calibrated to the New International Inch.

These are the words of two of America's acknowledged tooling leaders, active heads of one of America's foremost independent producers of accurate dies—carbide, lamination, progressive, and other precision tooling.

Says Herb Harig, president of Harig Manufacturing Corporation and former president of National Tool & Die Manufacturers Association: "Moore's line of Jig Borers and Jig Grinders has been an integral part of the development of our company from 15 employees in 1937 to 120 today. We have always been among the first to install each new model. That's why we are among the first with Moore's tenth-splitting No. 3 Jig Borer and No. 3 Jig Grinder. Over the years we have en-

larged our Moore Jig Boring and Jig Grinding Department to 15 machines!"

Sums up Chairman Karl Harig: "When owner-management invests its money in machinery, it does so only after thorough analysis and careful selection. I don't know of any machine manufacturer which meets both these tests better than does Moore."

We stand ready to help you duplicate Harig's record of satisfaction. As a start, write today for our detailed literature on these new tenth-splitting machines with larger tables; hardened, ground and lapped ways; no gibs, no overhang.

MOORE SPECIAL TOOL COMPANY, INC.

734 Union Avenue, Bridgeport 7, Conn.

ADD



TO YOUR TOOLROOM

JIG BORERS . JIG GRINDERS . PANTOGRAPH WHEEL DRESSERS . PRECISION ROTARY TABLES . HOLE LOCATION ACCESSORIES

MACHINERY, August, 1960

For more data circle this page number on card at back of book



Specify PANNIER STEEL STAMPS for a longer life of CLEANCUT MARKING

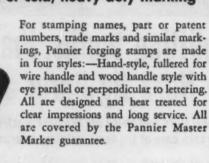
29,335 hammer blows—and still marking cleanly—Pannier Letter and Number Stamps



Hand-style

Made of the finest tool steel and correctly heat treated for best combination of hardness and toughness, Pannier single character stamps can take it! Scientific shaping and accurate engraving insure a long life of good, clear impressions. Available in letters, figures and special symbols, and in light, medium or heavy duty design.

Extra tough steel forging stamps for hot or cold, heavy duty marking



Supreme Holders with "Roto-Pin" for quick, easy number change



ndle style

Roto-Pin makes this Pannier Master Marker a time saver in number change and makes serial number marking fast and efficient. The hardened anvil at the base of the type slot keeps type in perfect alignment for equal impression. Machined from bar tool stock, the Supreme Holder has a heat treated striking head. Both anvil and striking head head to longer life of the holder itself. Made in hand or wood handle styles, for hot or cold marking.

Write for literature



PANNIER
MASTER
MARKERS
FOR QUALITY

GISHOLT MACHINE Co., Madison, Wis., announces the retirement of WOODBRIDGE BISSELL, production manager, after more than thirty years of service. He came to Gisholt in 1929 after eight years in the steel-making field. John C. Weston has been appointed to fill the position of production manager left vacant by the retirement of Mr. Bissell.

JACK H. DEKRUIF has been appointed vice-president of marketing and sales for WARNER ELECTRIC BRAKE & CLUTCH Co., Beloit, Wis. He will be in charge of brake and clutch sales for the company's three major divisions—mobile homes and travel trailers, automotive air conditioning, and capital goods.

New England

LOUIS E. BOURGEOIS has been appointed New England district supervisor for the VASCOLOY-RAMET CORPORATION, Waukegan, Ill. Mr. Bourgeois will headquarter in Simsbury, Conn., at 14 Tomstead Road, where he will supervise sales and service of V-R products in the states of Connecticut, Rhode Island, Massachusetts, Maine, New Hampshire, and Vermont, as well as several counties in northeastern New York.

ALFRED J. CARLETTI has been appointed manager-headquarters manufacturing of General Electric's DISTRIBUTION ASSEMBLIES DEPARTMENT in Plainville, Conn. This department manufactures lighting and distribution panelboards, switchboards, motor control centers, and busway for commercial and industrial use.

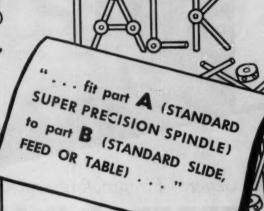
MARLIN-ROCKWELL CORPORATION has announced three new appointments at its Plainville, Conn., plant. HENRY MAIKOWSKI, formerly person-



Henry Maikowski, factory superintendent, Marlin-Rockwell Corporation

TINKER

FOR THE SPECIAL MACHINE DESIGNER



That's the Standard "Building Block" method of special machine design . . . simple as that, a Standard Super Precision spindle to mill, drill, grind or bore the work . . . coupled with the right Standard slides, feeds or swivels to either bring the spindle to the work or the other way 'round.

Recommended procedures:

- Send for our new catalogue. It's filled with special machines we've built for design engineers — machines that have whipped ornery problems all over the nation.
- Or, send us a rough sketch of the problem (or describe it). The chances are we've made one almost like the one you need. We'll send you back the "building block" answer.

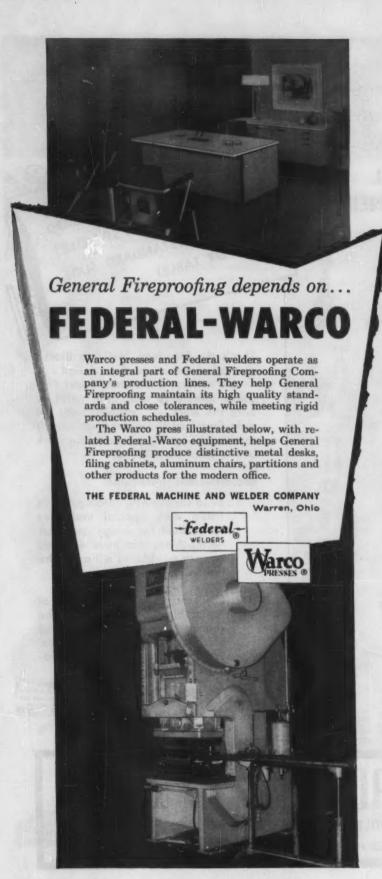
BUT, DO IT TODAY!



the STANDARD electrical tool co.

SUPER PRECISION SPINDLES AND MACHINE TOOLS
2500 RIVER ROAD • CINCINNATI 4, OHIO

Booth 1450 MACHINE TOOL EXPOSITION Sept. 6-16 Chicago, III.



nel director, has become factory superintendent responsible for all manufacturing operations. Ensuco L. Bossi has advanced from factory superintendent to staff assistant to the plant manager. The new personnel director is Franklyn E. Pavlik.

DAVID E. GLASS has been appointed sales manager of the Machine Tool. Division of the Producto Machine Co., Bridgeport, Conn. In his new post Mr. Glass will co-ordinate the activities of Producto's machine tool distributors throughout the country and will be directly responsible for sales in New England.



Paul N. Stanton, vice-president of marketing, Pratt & Whitney Co., Inc.

Paul N. Stanton has been named vice-president of marketing of Pratt & Whitney Co., Inc., West Hartford, Conn. In his new post Mr. Stanton will be responsible for all sales, market research, and advertising activities for the company's line of machine tools, cutting tools, and gages.

S. W. CARD DIVISION of the Union Twist Drill Co., Mansfield, Mass., has appointed RICHARD KANDARIAN as field engineer covering the state of Michigan. Jack L. Hornbeck has also been appointed field engineer and will cover northern California.

Mason-Neilan Division of the Worthington Corporation, Norwood, Mass., announces the appointment of Eric A. Bianchi as general manager. The division manufactures automatic valves and instruments.

Brown & Sharpe Mfg. Co., Providence, R. I., announces the retirement of James Meehan, assistant to the general sales manager of the Machine Tool Division. Mr. Meehan is leaving after forty-three years of service with the company.

Are You Caught.

BETWEEN RISING LABOR COSTS AND CUSTOMER RESISTANCE TO INCREASED PRICES?

A prominent machine tool builder* now saves \$1,138.10 in man hours on each spline hobbing machine by using a HILL ACME Surface Grinder to produce flat, parallel ways as compared with their old method of planing and hand scraping: —

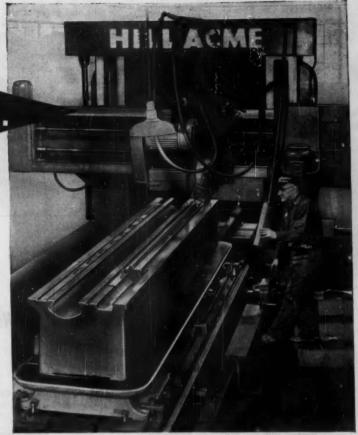
Here is the case history:

ITEM	METHOD	HOURS	RATE		TOTAL FOR COST	
Bed 8'x72"	Scrape Grind	96.0 22.5		\$1	,014.72 282.37	
			1.	\$	732.35	Savings
Slide	Scrape Grind		2.35 2.79	\$	126.84 10.04	
				\$	116.80	Savings
Carriage	Scrape Grind		2.35 2.79	\$	264.25 75.30	
				\$	188.95	Savings
To	tal man-	hour Sa	avings	\$1	,138.10	

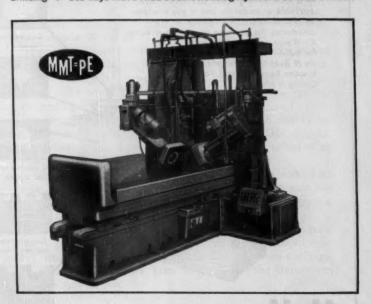
The manufacturer reports these additional advantages:

- 1 A consistency of way accuracy assured.
- 2 Permits the use of integral hardened ways.
- 3 Gives a uniform oil film between way surfaces.
- 4 Improves delivery schedules.
- 5 A very favorable customer acceptance.

HILL ACME Heavy Duty Hydraulic Surface Grinders are adaptable to a wide variety of stock sizes having flat surfaces. Table widths are 24" to 60". Table lengths vary from 7 to 30 feet. Built in both horizontal spindle and vertical spindle design.



Grinding "V" bed ways with a HILL Double Housing Hydraulic Surface Grinder.



* Builders Name on request



THE HILL ACME COMPANY

1201 WEST 65th STREET CLEVELAND 2, OHIO Manufacturers of: Grinding and Polishing Machines • Hydraulic Surface Grinders • Rotary Scrap Shears • "ACME" Forging • Tapping Machines • "CANTON" Alligator Shears • Bar-Billet Shears • "CLEVELAND" Knives & Shear Blades WANSKUCK Co., Providence, R. I., announces the purchase of the Production Machine Co., Greenfield, Mass., manufacturer of centerless grinders and polishing and buffing machines. The firm will continue to operate in Greenfield with its existing personnel. Anthony J. Spada has been appointed general manager of the firm to replace the late Raymond A. Cole.

New York and New Jersey

Wood & Spencer Co., Cleveland, Ohio, has appointed Van Kleeck, Inc. as distributor for its line of pre-

cision taps and gages in the Greater Buffalo area. Van Kleeck is at 123 Michigan Ave., in Buffalo, N. Y.

WILLIAM C. STOLK has been elected chairman and chief executive officer of the AMERICAN CAN Co., New York City, and Roy J. Sund has been elected president. Mr. Stolk had been president of the company since 1951 and chief executive officer since 1952. Mr. Sund has been a director of the company, vice-president in the corporate executive department, and general manager of the Marathon Division. Mr. Sund and William F. May,

Cuts internal

keyways

Cuts any shapes

corporate vice-president and general manager of the Canco Division, were elected members of the executive committee of the board of directors. Donald A. Snyder, formerly assistant general manager of the Marathon Division, will succeed Mr. Sund as general manager. He was also elected a vice-president in the corporate executive department.



Paul L. McCulloch, Jr., vice-president of the American Brake Shoe Co. and group executive of the Industrial Castinas Group

AMERICAN BRAKE SHOE CO., New York City, announces the formation of an Industrial Castings Group composed of four of the company's divisions: American Manganese Steel Division, Electro-Alloys Division, Engineered Castings Division, and National Bearing Division, which operate a total of fifteen plants throughout the United States. Paul L. McCulloch, Jr., has been elected a vice-president of the company and appointed as group executive. The divisions which comprise the new



William D. Raddatz, president of the Electro-Alloys Division of the American Brake Shoe

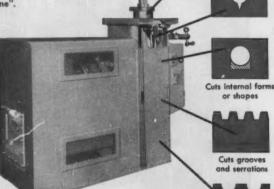
TRIPLE THE USEFULNESS OF YOUR M&M

KEYSEATER AND VERTICAL CUTTING MACHINE

Simple modification greatly increases productive capacity of this versatile machine.

An M & M Hydraulic Keyseater is not only a keyseater that cuts internal keyways up to 5" wide but a vertical cutting machine as well. Serrations, grooves, teeth—a wide

variety of cuts can be rapidly made on this machine with only one simple modification
— a work-holding table. This table is now available at moderate cost. If you now own an M & M Hydraulic Keyseater or are considering the purchase of a new keyseater it will pay you to get the facts. Write for Bulletin 19 entitled, "Converting the M & M Keyseater into a combination Keyseater and Vertical Cutting Machine".



M&M KEYSEATERS
AND VERTICAL CUTTING MACHINES

MITTS & MERRILL • 64 Holden Street • SAGINAW, MICHIGAN

264

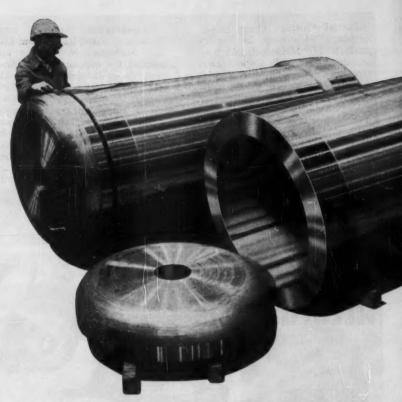
"Will the weld be as strong as the cylinder?"

Marion Power Shovel asked this question when we recommended two-piece forgings (at considerable savings over the former one-piece forgings) for use as jack cylinders in their giant electric shovels. We answered "yes"... and tests show the weld metal has higher mechanical properties than the minimum physicals required for the cylinder.



cylinders, like those above, are used to keep the upper frame of this Type 5761 Electric Shovel level during operation. Made by Marion Power Shovel, Marion, Ohio, this shovel's dipper has a 65 cu yd capacity.





BECAUSE THE HOLE at the cylinder end is small, machining the sleeve before the head is welded on is lots easier and faster than machining the former one-piece forging. There's more room to work; the tool can get a good grip on the piece, hog out the metal, instead of pick it out. The savings are more than enough to offset the added welding cost.

Forged from manganese-vanadium steel, this sleeve-and-head cylinder weighs 22,690 lb.

The sleeve itself is 9 ft, 10 in. long, with a body OD of 45 in. Flange OD is 48 in.; flange ID, 35 1/4 in. The wall is 5-in. thick. To produce it, we upset, punch, hollow-forge, double-normalize and temper. Then we finish-machine to size, including the weld bevel on the end of the sleeve.

We forge the head as a disc of 49 in. diameter, and 11-in. long. Then we finish-machine it to size (45-in. OD, 9¾-in. long), including the weld bevel, and treat it the same as the sleeve.

The two pieces are then assembled and welded. The cylinder receives a stress-relief anneal after welding, and the weld is radiographed to assure soundness. Excess weld on the OD and ID is then machined off.

If you have a forgings problem, Bethlehem is a good company to get in touch with. We think as hard about one-pound drop forgings, as we do about 200-ton press forgings. To start us thinking about your forging, call the Bethlehem sales office nearest you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



Industrial Castings Group manufacture a wide range of foundry products. Mr. McCulloch had been president of the ELECTRO-ALLOYS DIVISION. Succeeding him in this position is WILLIAM D. RADDATZ.

VERNITRON CORPORATION, specializing in the manufacture of precision synchros, resolvers, and servo components, has moved its executive and research and development offices to 125 Old Country Road, Carle Place, Long Island, N. Y. Engineering and manufacturing operations will continue at the company's West Coast plant in Torrance, Calif.

Consolidated Machine Tool. Division of Farrel-Birmingham Co., Inc., Rochester, N. Y., has announced the appointment of three West Coast distributors to handle the company's line of heavy-duty machine tools. Included in this broad line of equipment are heavy-duty lathes, boring mills, milling machines, and special machine tools. The Tornouist Machinery Co., 3825 Santa Fe Ave., Los Angeles 58, Calif., will handle the southern part of California bounded on the north and including the counties of San Luis Obispo, Kings, Tulare and Indio. Also included are the counties

of Esmeralda, Nye, Lincoln, and Clark in Nevada. B-H-S MACHINERY Co., 717 Airport Boulevard, South San Francisco, Calif., will handle the northern section of California. In the states of Washington, Oregon, and Idaho, Consolidated will be represented by the PORTLAND MACHINERY Co., 208 Southwest First Ave., Portland 4, Ore.

ROBERT W. PEARSON has been appointed to the newly created staff position of director of production for the AMERICAN MACHINE & FOUNDRY CO., New York City. He was formerly director of manufacturing for the company's Government products group.

ROBERT A. LODDENGAARD has joined Servo Corporation of America, Hicksville, N. Y., as servo instruments section manager, Industrial Products Engineering. Mr. Loddengaard assumes responsibility for the research development and design of control systems, servo instruments, and components for industrial application.

Tore N. Anderson has been elected executive vice-president and general manager of FXR, Inc., Woodside, N. Y., manufacturers of microwave and other electronic equipment.

THOMAS C. WILSON, INC., Long Island City, N. Y., announces the election of MRS. MARTHA A. WILSON as board chairman; O. J. BAGNOLI as president; and ALEXANDER JOHN as vice-president. Wilson manufactures precision tube cleaners, tube expanders, and allied tools, in addition to portable pneumatic production tools.

COLUMBIAN BRONZE CORPORA-TION, Freeport, N. Y., manufacturer of marine propellers, announces the appointment of DOUGLAS T. ABBOTT as vice-president and assistant general manager. Mr. Abbott has served the company as chief engineer and, since 1957, as vice-president for sales and engineering.

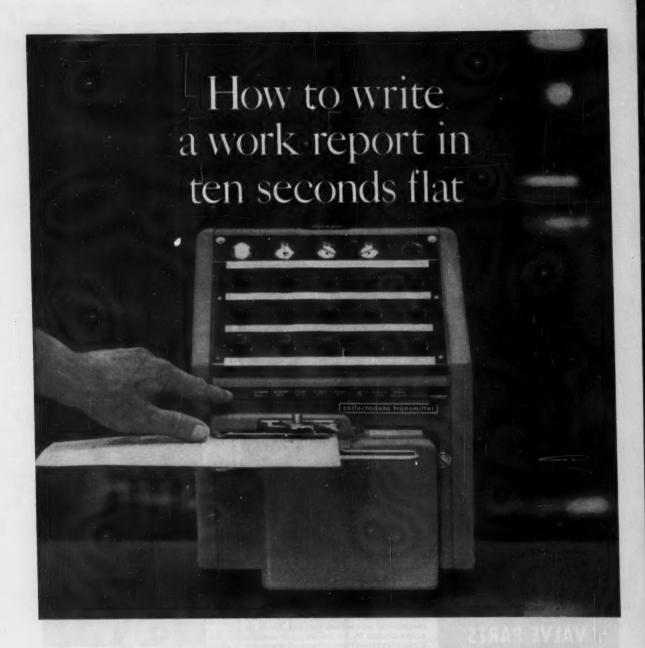
DANIEL B. LAMB has been appointed Detroit division manager for OAKITE PRODUCTS, INC., New York City. He replaces THOMAS R. SMITH who is retiring after thirty-three years with Oakite, nineteen of those years as head of the Detroit division.

Ex-Cell-O Corporation, Detroit, Mich., announces the appointment of Edwin P. Nelson as district manager of the company's New



SEE US AT BOOTH 240 PRODUCTION ENGINEERING SHOW

SEPTEMBER 6-16 NAVY PIER CHICAGO, ILLINOIS



"Keeping track" is a fantastic problem in today's factory. Far and away the best (and cheapest) solution is a Friden Collectadata system. It works like this:

- Work orders are issued in the form of tab cards or edge-punched documents.
- When a job is completed, the worker puts his card in a Collectadata transmitter and touches a button.
- The Collectadata receiver in the data center receives and automatically punches the information into a paper tape and records the time.
- At day's end, the tape is processed—fed either into tape to tab card converter, or directly into computer to prepare a complete summary of work activity.

All plant activity — from receiving dock to shipping room — can be reported and recorded by this same simple method. For information, talk to your Friden Systems Man or write: Friden, Inc., San Leandro, Calif.

THIS IS PRACTIMATION: automation at the source of data with practical, sensibly priced equipment.

D 1900 PRIDEN, INC



SALES, SERVICE AND INSTRUCTION THROUGHOUT THE U.S. AND THE WORLD

York-Philadelphia area office in Springfield, N. J.

Ohio

THOMAS A. FRIBLEY has been elected president of the CLEVELAND CAP SCREW Co., Cleveland, Ohio. He succeeds his father, the late Joseph W. Fribley. The Cleveland Cap Screw Co. is, a wholly owned subsidiary of Standard Pressed Steel Co., Jenkintown, Pa.

TAP CARTRIDGE Co., Cincinnati, Ohio, manufacturers of wax cartridges for chip-free, blind-hole tapping, have moved their offices and manufacturing facilities to 326 Railroad Ave. in Cincinnati. Also, ROB-BERT M. LOEBELSON has been named vice-president of the firm.

AERONCA MFG. CORPORATION, Middletown, Ohio, has purchased the UNITED WELDING Co., also of Middletown, a former division of Baldwin-Lima-Hamilton Corporation. The cash purchase price of \$650,000 included United Welding's name, good-will, and inventory as well as a lease with option to buy on land, buildings and equipment valued at \$550,000. No exchange of stock was involved in the transaction between the companies.



Philip O. Geier, Jr., vice-president and assistant general manager, Cincinnati Milling Machine Co.

CINCINNATI MILLING MACHINE Co., Cincinnati, Ohio, announces the election of PHILIP O. GEIER, JR., as vice-president, and his appointment as assistant general manager. Mr. Geier was formerly manager of the company's Product Division.

WILLIAM B. RADKE has been promoted to controller of the CLEVE-LAND WORM & GEAR and FARVAL DIVISIONS OF Eaton Mfg. Co., Cleve-

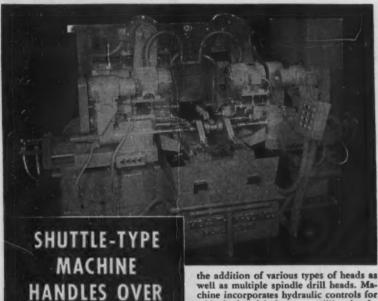


William B. Radke, controller, Cleveland Worm & Gear and Farval Divisions, Eaton Mfg. Co.

land, Ohio. He succeeds FLOYD H. NEEL who is retiring after fortythree years of service.

Pennsylvania and North Carolina

SKF INDUSTRIES, INC., Philadelphia, Pa., announces appointments to three eastern sales posts. Donald H. Amdon was named to the newly created post of manager, aircraft sales, Eastern Region, and will be located at the company's Hartford,



... Mills, Centers, Tap Drills and Taps in #316 Stainless

40 DIFFERENT

VALVE PARTS

Here's a good example of engineering a semi-standard machine to handle a lot of parts. Although this machine has been adapted to milling, centering, drilling and tapping of valve parts, its basic design leads itself to other operations through

the addition of various types of heads as well as multiple spindle drill heads. Machine incorporates hydraulic controls for table feed and index, two milling heads, two hydraulic power heads, each with center drill and tap drill spindle, and two mechanical screw feed tapping heads to accommodate 16, 20 and 24 pitch threads. Capacities range from 36" to 4½" diameter, 5" to 23" long. Parts are inner valves for liquid level controls of tough \$316 stainless steel.

If you need high production of one part or moderate production of many parts with a minimum capital outlay, it will pay you to call in a D & T production engineer. There is no obligation for this service.

FREE DATA







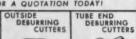
You are welcome to our 25 years experience in designing and producing Special Cutting Tools.

Submit your problem— with sample part, if feasible OR we'll manufacture to your specifications.

Savetance SPECIAL CUTTERS shipped monthly!

ASK FOR A QUOTATION TODAY!

CHITTERS







CARBIDE MILLS

MIDGET MILLS

CHATTERLESS





Severance tool INDUSTRIES INC. 636 lowa Avenue SAGINAW, MICHIGAN

REGRINDING

For more data circle Item 269A



Popular package is 8-oz. can fitted with Bakelite cap holding noft-hair brush for applying right at bench; metal surface ready for ayout in a few minutes. Le dark blue background akes the scribed lines how up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

THE DYKEM COMPANY

END NIGHT CLEANUP & MORNING REBLUING

DYKEN HI-SPOT BIBE Ho. 167 is used to locate high spots
when scraping bearing surfaces. As it does not dry,
it remains in condition on work indefinitely, saving
scraper's time. Intensely blue, smooth pasts
spreads thin, transfers clearly. No grit; nonlinurious to metal. Uniform. Available in collapsible
tubes of three sizes. Order from your supplier.
Write for free sample tube on company letterhead.

DYKEM GO., 2008 NORTH 11114 ST., 5T. LOUIS 6, MO.
For more data circle Item 2698

For more data circle Item 269B



For more data circle Item 269C



Scheduled for use in a Vertical Quintaplex Hydraulic Pump is this 680 pound rawhide pinion — 21.6" O.D., 17" F., 5½" B., with bronze-flanged cast-iron center, 25 T., 1½ D.P., and 3 pound rawhide pinion—3.666" O.D., 3" F., bronze bound; together with bakelite pinions and Fibroil bevel

blanks. Quiet operation is enhanced by money-saving stamina. Be certain of flawless gear performance -contact Stahl first.

CONTINUOUS TOOTH HERRINGBONE TO 60 PD 2 DP HEAT TREATED. CASE OR FLAME HARDENED GEARS— OF CARBON OR ALLOY STEEL

GEAR & MACHI COMPANY

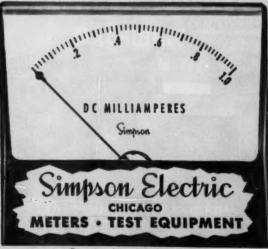
3901 HAMILTON AVENUE CLEVELAND 14, OHIO

For more data circle Item 269D

SIZE CONTROL CO.

CHICAGO





For more data circle Item 269E

Conn., field office; EDGAR K. LOFTON was named district manager, New York; and GUY G. WENNER was named district manager, New England.

JOSEPHINE M. SHEA has been appointed manager of advertising for the CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa. Mrs. Shea was Crucible's assistant manager of advertising for several years.

PETER S. GIVEN has been appointed to the newly created post of manager, airborne products, SKF INDUSTRIES, INC., Philadelphia, Pa. Mr. Given will retain the responsibilities of his former assignment as assistant chief engineer while adding the coordination of all phases of manufacture, sales, and engineering of airborne products.

JOHN E. STARK has been appointed assistant vice-president—industrial relations of the Westinghouse Air Brake Co., Pittsburgh, Pa.

MILTON O. SCHUR has been named vice-president for research of the PACKAGING DIVISION of Olin Mathieson Chemical Corporation in Pisgah Forest, N. C.

Obituaries

Joseph W. Fribley, founder and president of the Cleveland Cap Screw Co., died June 6 in Hanna House of the University Hospital, Cleveland, Ohio. He was seventy-three years of age. Mr. Fribley was also a director of the Standard Pressed Steel Co., Jenkintown, Pa.



Joseph W. Fribley

T. HEBERTON DOAN, chairman of the board of the Foote-Burt Co., Cleveland, Ohio, and a nationally known figure of the machine



T. Heberton Doan

tool industry, passed away on July 8 at his home in Cleveland Heights. His age was sixty-nine. Mr. Doan, a native of Philadelphia, became an apprentice of the Foote-Burt Co. at the age of sixteen and at a wage of

COLUMBIA

VANADIUM FIREDIE (type H13) the "Old Pro" unbeaten champion of the hot work steels





GEARS

Designed and Manufactured to meet YOUR

Production Requirements

Custom Gears Exclusively

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GEAR CORPORATION SYRACUSE 1. N. Y.

For more data circle Item 271A



TRIAL SAMPI

SPECIAL LUBRICANT EASES WORKING STAINLESS AND TOUGH METALS

New lubricant eases stamping and machining operations on the toughest metalworking jobs-takes the problems out of hard-to-work metals such as stainless, high carbon, high chrome, cast iron, monel, etc. Scientifically developed ANCHORLUBE now used extensively in a wide range of applicationsdrilling, tapping, spot facing, counter-boring, milling, fly-cutting, seat forming, engraving, broaching, drawing, piercing, punching, hole extruding, etc. Application by swab, spray, roller or brush. Send today for free trial sample and see for yourself how easy you can work the job with ANCHORLUBE.

ANCHOR CHEMICAL COMPANY
Dept. M-8 - 10721 Briggs Road - Cleveland 11, Ohio

For more data circle Item 271B

ALL MAKES . . . Special and standard RECIBION GEARS UP TO 200 DIAMETRAL PITCH

All Gears certified for Accuracy Quality and Fine Workmanship

NEW JERSEY GEAR & MFG. CO.

Billaide, N. J. For more data circle Item 271C

JIG AND FIXTURE DESIGN

A practical book with 382 pages of information on the design and construction of Jigs and fixtures for drilling, boring, planing and milling. \$5 per copy. Sent on approval.

MACHINERY, 93 Worth St., New York 13, N. Y.

A MuSt! for every MACHINERY USER COLISEUM 7th - 15th 1513 So. Wabash Ave. CHICAGO 1960 1 to 10 P.M. Daily NOT OPEN SUN., SEPT. 11 . THE SHOW TO SEE! IMPORTED AND AMERICAN MACHINERY To Effect Economies in Your Plant Officers, Trustees, Department Supervisors, Buyers and all Plant Employees . . . WRITE FOR INVITATIONS entitling you to register for any or all eight days of this GREAT MACHINERY CLASSIC to: A. BYRON PERKINS & ASSOCIATES, Inc.

For more data circle Item 271D

2216 So. Hill St., Los Angeles 7

Phone: Richmond 9-5071

75 cents a day. After completing his apprenticeship and gaining experience in other departments, he was made purchasing agent of the company. With the stepped up demands of World War I, he became general manager. Success in that position earned Mr. Doan the post of vice-president in 1919. He was elected president of the company in 1933 and chairman of the board in 1959. Having been with the Foote-Burt Co. for a period of fifty-four years, he was the oldest employe in point of service.

New Books and Publications

HARDNESS: THEORY AND PRACTICE.

PART 1: PRACTICE. By Louis
Small, 509 pages; 303 illustrations; 6 by 9 inches. Published
by The Industrial Press, 93
Worth St., New York 13, N. Y.
Price, \$10.

A book such as this belongs in the library of every technical school and manufacturing organization. In a single source, it shows the construc-

WESTFIELD, NEW JERSEY

tion, specifications, operation, description of method, evaluation of results with standards pertaining to all types of hardness tests and testing equipment. In addition, Mr. Small brings the subject of hardness testing up to date by including the theory and practice of hardness testing as they relate to specific properties and applications.

Of special interest to inspection departments, engineers, and metallurgists, will be the description of the Rockwell hardness test at the pitch line of gears, to special applications involving small parts that are not flat, large or heavy pieces, and internal and automatic testing.

Other sections describe testing methods for plastics, thin materials, hot hardness of materials at temperatures up to 3000 degrees F., cemented carbides, plus special but significant practical situations.

The contents by chapter headings are: Definition; Brinell Hardness; Brinell Applications; The Rockwell Test; The Rockwell Superficial Test; Construction and Operation of Machines for Rockwell Testing; Applications of the Rockwell Test; Vickers or Diamond Pyramid Hardness; Knoop Microhardness Testing; MicroHardness Testing Applications in America; Scleroscope; Portable Hardness Testers: Sheet Metal Testing; Hot Hardness; Cemented Carbide Testing; International Standards; Plastics Testing; Hardness Conversion; Selection and Use of Steel; Hardenability and Jominy Test; Physical Properties of Heat Treated Steels and Tool Steel Applications.

HEAT TREATMENT OF METALS. By
P. S. Houghton. Vol. 1, 156
pages; Vol. 2, 183 pages. Illustrated; 5 1/2 by 8 1/2
inches. Published by The Machinery Publishing Co., Ltd.,
Brighton, England. Sold in the
United States by The IndusTRIAL PRESS, 93 Worth St.,
New York 13, N. Y. Price, \$3
each volume.

This is a two-volume work which describes, in simple terms, the annealing, hardening, and tempering processes used to prepare all grades of metal, including aluminum, magnesium, and other nonferrous alloys, for manufacturing and service. Metals of both British and American designations are covered in numerous tables.

Experience has shown that the heat treatment technique is often the



Firm Name

Firm Address

weakest link in the operating cycle and a cause of costly failures despite the growth of technical information available. This may be because heat treatment processes are relatively simple, thereby giving the casual observer a false impression of the amount of training and skill necessary to perform this process. Heat treating demands, from the worker, study, research, and experience.

The information in this book is based on the author's training and experience, plus some years of lecturing on production engineering subjects at Aston Technical College, Birmingham, England.

Coming Events

SEPTEMBER 6-16-Machine Tool Exposition, sponsored by the National Machine Tool Builders Association, to be held at International Amphitheatre, Chicago, Ill. For more information: Clapp & Poliak, Inc., 341 Madison Ave., New York,

SEPTEMBER 6-16-Production Engineering Show, to be held at Navy Pier, Chicago, Ill. For additional information, inquire of Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y.

SEPTEMBER 7-15-Second International Coliseum Machinery Show to be held at Chicago Coliseum, Chicago, Ill. For further information, write: A. Byron Perkins & Associates, 2807 Sunset Blvd., Los Angeles 26, Calif.

SEPTEMBER 11-20-German Machine Tool Exhibition to be held in Hanover, Germany, sponsored by Verein Deutscher Werkzeugmaschinenfabriken, Am Hauptbahnhof 6, Frankfort am Main, Germany. Requests for room reservations should be addressed to: Amt für Verkehrsförderung, Friedrichswall 5 (Laveshaus), Hanover, Germany.

SEPTEMBER 26-29-National Fall Meeting of the American Welding Society to be held at the Hotel Penn-Sheraton, Pittsburgh, Pa. For additional information: Arthur L. Phillips, American Welding Society, 33 W. 39th St., New York 18, N. Y.

OCTOBER 17-21-Forty-Second National Metal Exposition and Congress, sponsored by American Society for Metals, to be held at Philadelphia Trade and Convention Center, Philadelphia, Pa. For additional information: Chester L. Wells, exposition manager, American Society for Metals, Metals Park, Novelty,

OCTOBER 25-27-Eleventh National Conference on Standards under the auspices of the American Standards Association. The conference is to be held at the Sheraton-Atlantic Hotel, New York City, For additional information: K. G. Ellsworth, Public Relations, American Standards Association, 10 E. 40th St., New York 16, N. Y.

NOVEMBER 3 and 4-Annual Regional Conference and Convention of the American Institute of Industrial Engineers to be held at the Sheraton Plaza Hotel, Boston, Mass. For further information: Marshall Schneider, chairman, publicity committee, American Institute of In-dustrial Engineers, Inc., Boston,

NOVEMBER 14-18-Third Western Tool Show sponsored by the American Society of Tool Engineers, to be held at the Memorial Sports Arena in Los Angeles, Calif. For additional information write Leonard Abrams, exposition manager, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.



Oil shield. Air clutch. Left or right fly wheel mounting. Variable speed drive. Automatic feed. Automatic misfeed stop. Accurate top stop. Push button or dial speed controls. Electric speed indicator. J.I.C. wiring. Automatic lubrication. Stroke length and shut height to fit the job. Bronze gibs, etc.

Straight Side Punch Presses Single and Double Crank

Versatile, fast for volume production of small parts with large or progressive dies 20 to 150 tons.

- A completely new No. 3½ 27 ton punch press that offers many advantages.
- Improved frame design gives greater rigidity for better accuracy and longer die life.
- · Fully enclosed for extra safety and cleanliness.
- Speeds to 450 s.p.m. with 1" stroke (21/2" standard -4" maximum to order).
- Efficient at all speeds on all jobs.
- · Readily adaptable to special jobs at low cost.



NEW L&J CATALOG with complete spe cifications and construction features of 23 O.B.I. punch presses in geared and non-geared types from 14 to 90 ton capacities. Also, Straight Side Punch Press. Write for your copy now.

PRESS CORPORATION 1631 STERLING AVE.

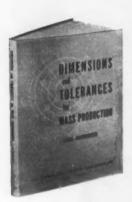
USEFUL BOOKS FOR **PRODUCTION ENGINEERS**



ENGINEERED WORK MEASUREMENT by Delmar W. Karger and Franklin H. Bayha.

An up-to-date, complete text on Methods-Time Measurement, the internationally recognized predetermined time systems, this book covers MTM thoroughly, expertly. Fourteen chapters describe the fundamentals of MTM, such as Reach, Move, Grasp, Release. Every term is clearly defined and illustrated. Special MTM mathematics, standards and applications, as well as organization and development of MTM training courses are covered. Engineered Work Measurement will help you in providing standard data and time formulas, controlling labor costs, evaluating existing systems, improving methods and estimating production costs.

630 pages, 130 illustrations. \$12.00

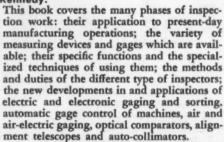


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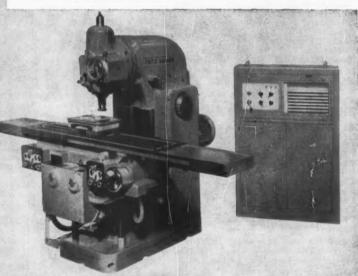
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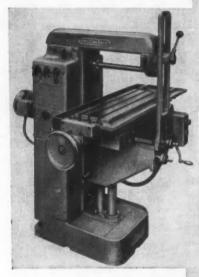
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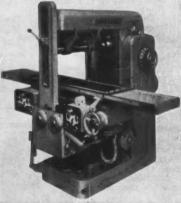


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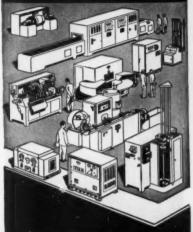
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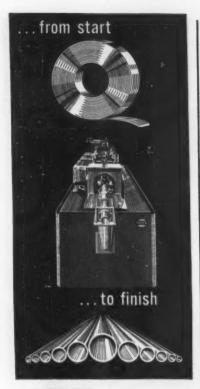
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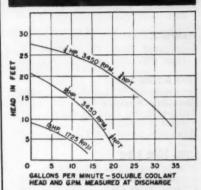


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